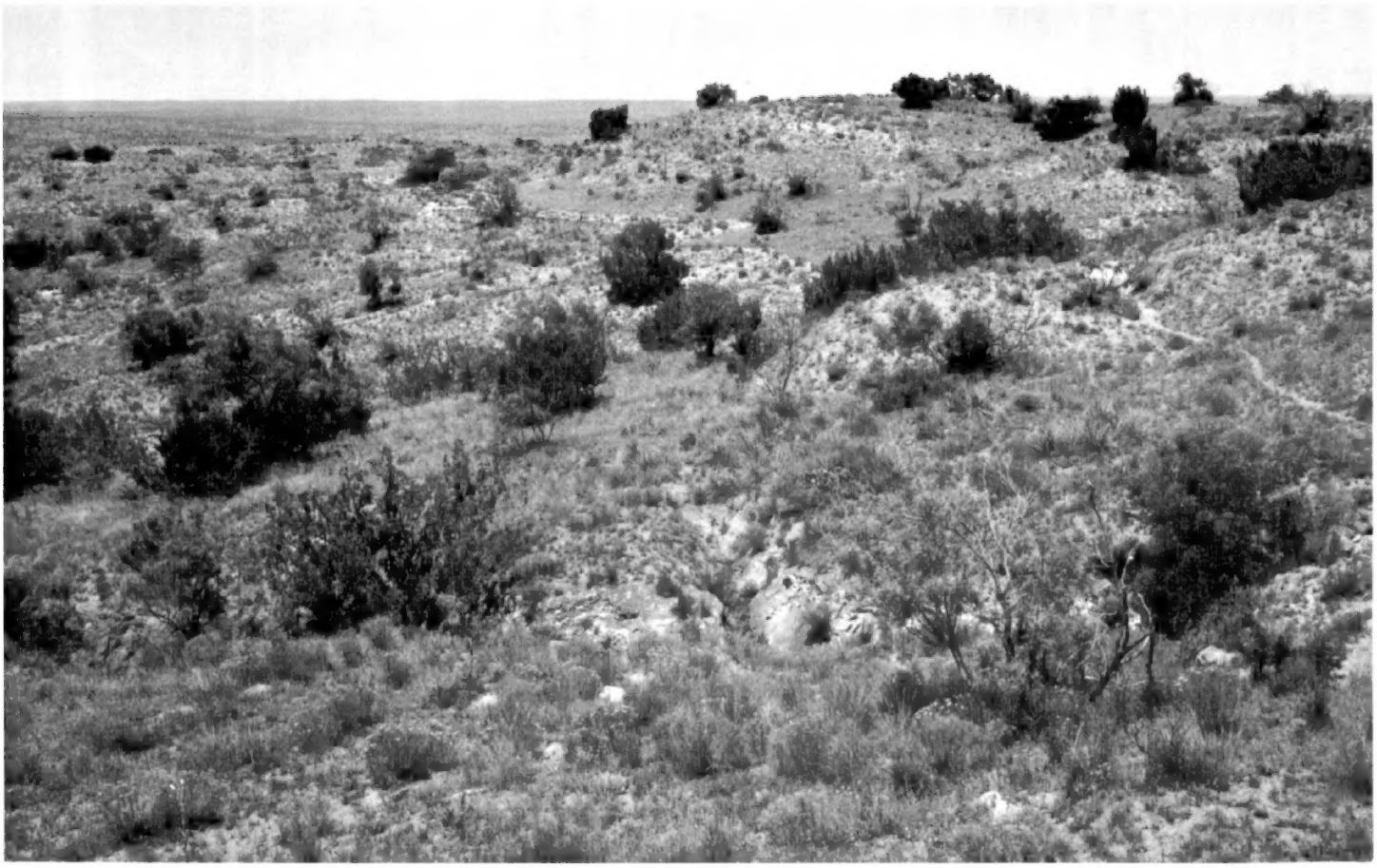
SOIL SURVEY OF

KENT COUNTY, TEXAS



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

Issued 1973

Major fieldwork for this soil survey was done in the period 1964-67. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Duck Creek Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased, on individual order, from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches and woodlands; in selecting sites for roads, ponds, buildings and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of Kent County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Management of the Soils for Wildlife."

Ranchers and others can find, under "Management of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers to Kent County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication.

Cover picture: Native range on Quinlan soils, sloping.

CONTENTS

SOIL SURVEY OF KENT COUNTY, TEXAS

BY WAYNE E. RICHARDSON AND C. L. GIRDNER, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN

COOPERATION WITH TEXAS AGRICULTURAL EXPERIMENT STATION

KENT COUNTY is located in the Southern Plains of Texas (fig. 1). It is in the Rolling Plains province of Texas. It has an area of 577,280 acres. Jayton, the county seat, is near the eastern edge of the county.

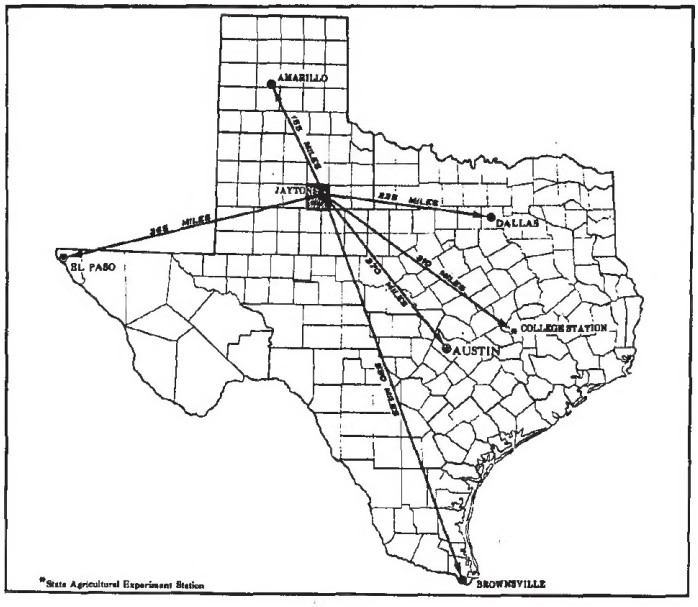


Figure 1.--Location of Kent County in Texas.

The county is bordered on the west by Garza County, on the north by Dickens County, on the east by Stonewall County, and on the south by Scurry County and Fisher County.

The county is typical of the Rolling Plains in that it is dissected by numerous drains, creeks, and two major rivers, all of which flow intermittently.

Farming is the primary enterprise, and oil production the second most important industry. Approximately 80,000 acres of Kent County is cultivated. Most of this cultivated area is dry farmed. The rest is range. Cotton, grain and forage sorghums, and wheat are the dominant crops grown. Cattle, raised mainly for beef, are the principal kinds of livestock.

HOW THIS SURVEY WAS MADE

Soil scientists made this survey to learn what kinds of soils are in Kent County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures as outlined in the Soil Survey Manual (5) 1/. The soil series and the soil phase are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Olton and Miles, for example, are the names of two soil series. All the soils in the United States having the same series

1/ Underscored numbers refer to Literature Cited, page 64.

name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Miles fine sandy loam, 0 to 1 percent slopes, is one of several phases within the Miles series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Kent County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Vernon-Badland complex, sloping, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Clairemont and Yahola soils, frequently flooded, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rough broken land is a land type in Kent County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

The soil scientists set up trial groups of soils on the basis of yield and practice tables and other data they have collected. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

GENERAL SOIL MAP

The general soil map at the back of this survey shows, in color, the soil associations in Kent County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Kent County are described in the following pages.

1. Quinlan-Rough broken land-Woodward Association

Gently sloping to steep, shallow and moderately deep soils that are very fine sandy loam throughout, and Rough broken land

This association is a complex pattern of gently sloping to steep ridges and knobs that have well-defined, deeply entrenched drainageways. The soils of this association formed in material weathered from Permian soft sandstone or packsand (fig. 2).

This association makes up about 27 percent of the county. It is about 35 percent Quinlan soils, 19 percent Rough broken land, and 13 percent Woodward soils. The remaining 33 percent is made up of less extensive soils of the Berda, Clairemont, Enterprise, Frio, Lincoln, Polar, Tivoli, Wichita, and Yahola series.

Quinlan soils lie on steep ridges and knobs and on side slopes that are less sloping than Rough broken land. They have a yellowish-red very fine sandy loam surface layer. Weakly cemented sandstone is at a depth of 10 to 20 inches.

Rough broken land consists of steep, rough and broken areas along the rivers, streams, and deeper drainageways where geologic erosion has cut deep gullies into the Permian sandstone and packsand.

Woodward soils are on the less sloping and less broken areas of this association. They have a surface layer of yellowish-red, very friable, very fine sandy loam. Unweathered red beds underlie these soils at a depth of 24 to 48 inches.

This association is mostly in native range. A few areas of the less extensive soils are cultivated. The soils in this association are best suited to range because the complex slopes and the rough, broken, and dissected topography make them unsuited to cultivation.

2. Miles Association

Nearly level to gently sloping, deep soils that have a fine sandy loam surface layer and sandy clay loam lower layers

This association consists of broad, nearly level to gently sloping areas that are dissected by a few small creeks and drains. Most of the soils in this association formed in sandy outwash or old alluvium.

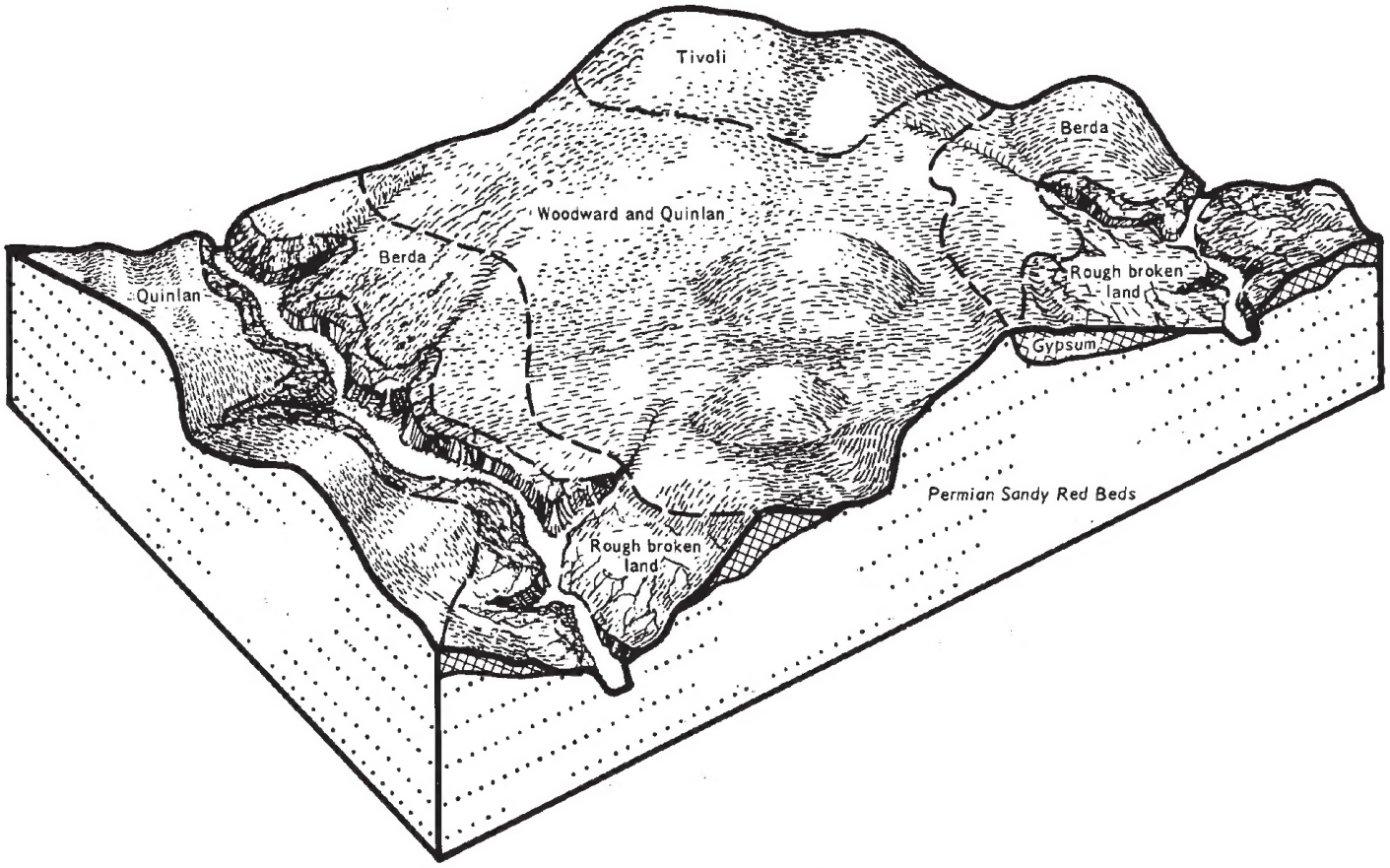


Figure 2.--Pattern of soils and parent materials in the Quinlan-Rough broken land-Woodward association

This association covers about 19 percent of the county. Miles soils are dominant and occupy about 55 percent of the association. The other soils that make up the remaining 45 percent are Abilene, Berda, Cobb, Obaro, Olton, Polar, Spade, Springer, and Weymouth.

Miles soils have a brown fine sandy loam surface layer underlain by friable sandy clay loam.

Less than half of this association is cultivated. Most of the soils are suitable for cultivation, but they are located within large ranches, and owners prefer to use them for range.

3. Nobscot-Brownfield Association

Gently undulating, deep soils that have a fine sand surface layer and fine sandy loam or sandy clay loam lower layers

This association consists of broad, gently undulating ridges that have poorly defined drainageways. The soils in this association formed in material weathered from sandy earths that appear to have been deposited by wind (fig. 3).

This association occupies about 17 percent of the county. Nobscot soils make up about 56 percent of this association, Brownfield soils 30 percent, and Miles and Springer soils 14 percent. Nobscot soils have a grayish-brown fine sand surface layer underlain by fine sandy loam. Brownfield soils have a brown fine sand surface layer and lower layers of friable sandy clay loam.

The larger part of this association is in native range. The soils are highly susceptible to soil blowing if unprotected by vegetation. They have a low available water capacity.

4. Olton-Weymouth Association

Nearly level to gently sloping, deep and moderately deep soils that are mainly clay loam throughout

This association consists of broad, nearly level to gently sloping areas and numerous low knobs and

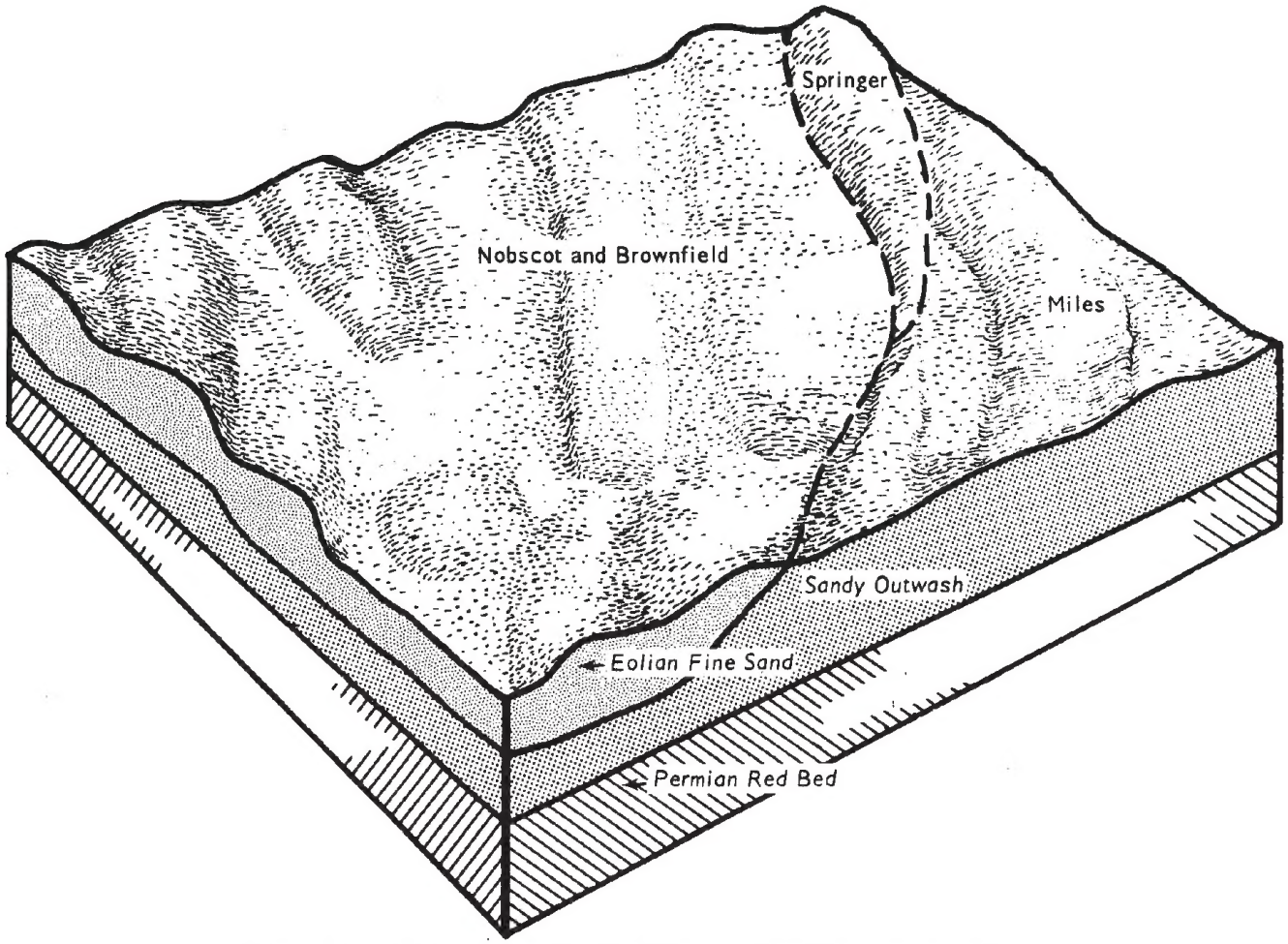


Figure 3.--Soil pattern in the Nobscot-Brownfield association

ridges. The Olton soils in this association formed in calcareous, moderately fine textured old alluvium or outwash deposits. The Weymouth soils formed in material weathered from red-bed clay and shale.

This association covers about 17 percent of the county. Olton soils make up about 54 percent of the association, and Weymouth soils 11 percent. The remaining 35 percent is mostly Abilene, Cottonwood, Latom, Obaro, Miles, and Vernon soils (fig. 4).

Olton soils are on the smoother parts of this association. They have a reddish-brown clay loam surface layer and blocky, firm, clay loam lower layers.

Weymouth soils are on the small ridges and knobs. They have a reddish-brown clay loam surface layer and reddish-brown and red, friable, clay loam lower layers.

More than half of this association is in range, although most of the soils are suitable for cultivation.

5. Obaro-Paducah Association

Gently sloping, moderately deep and deep soils that have a loam surface layer and loam or sandy clay loam lower layers

This association consists of broad areas of gently sloping knolls and ridges and many small drains and creeks. The major soils of this association formed in material weathered from soft, silty, Permian red-bed sandstone or packsand (fig. 5).

This association occupies about 10 percent of the county. Obaro soils make up about 54 percent of this association, and Paducah soils 12 percent. The remaining 34 percent is made up mostly of Cottonwood, Olton, Quinlan, Weymouth, Wichita, and Woodward soils and Rough broken land.

The gently sloping Obaro soils are on knolls and ridges above Paducah soils. They have a reddish-brown, calcareous, loam surface layer underlain by very friable loam.

Paducah soils are gently sloping and occur in concave positions. They have a reddish-brown loam surface layer underlain by firm sandy clay loam. Quinlan

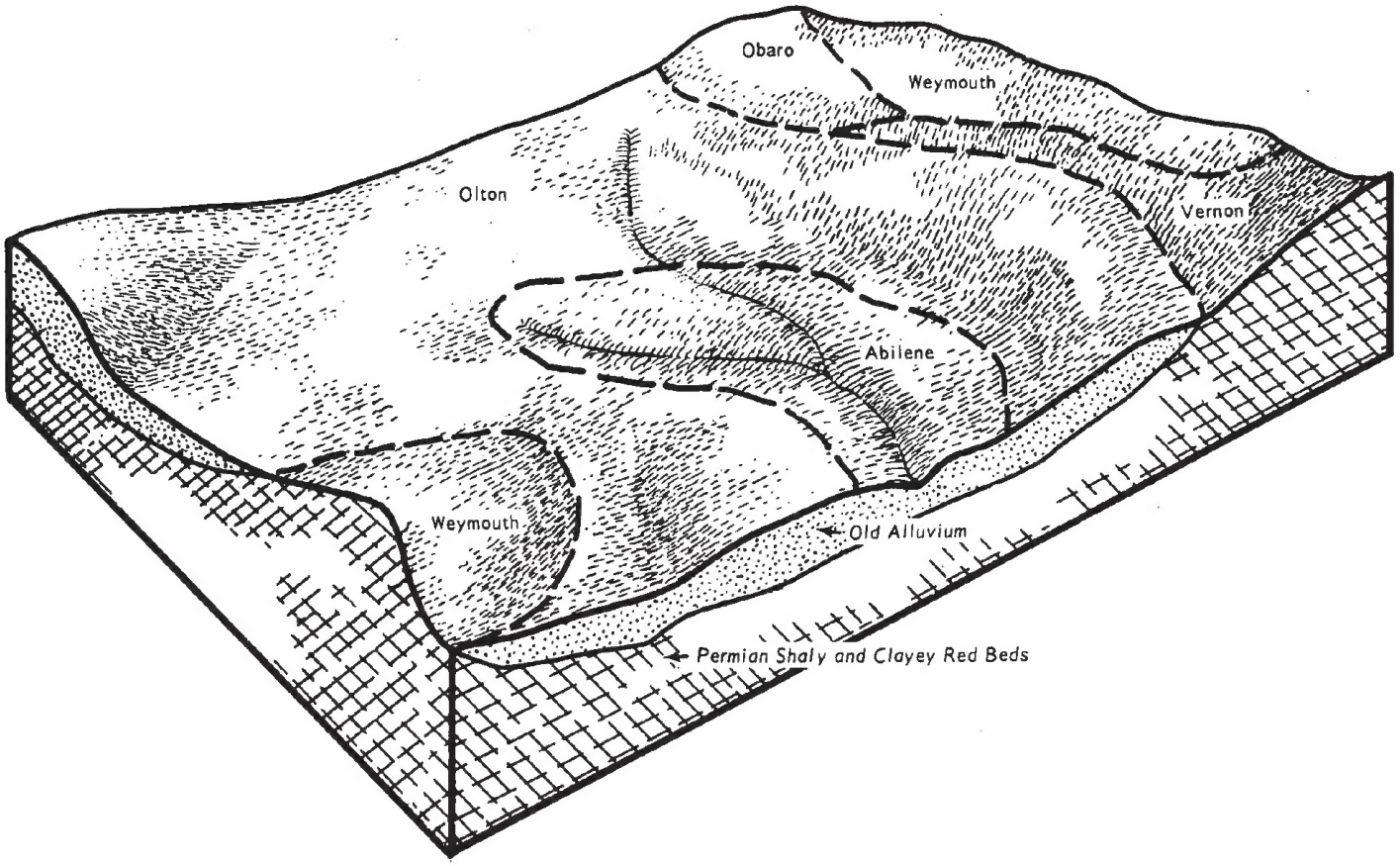


Figure 4.--Pattern of soils and parent materials in the Olton-Weymouth association

soils are mostly on the steeper ridges and along breaks to natural drains.

Most of this association is in native range. A large part of the association is suitable for cultivation. Open to sparse stands of mesquite trees grow on the more sloping and steeper soils, and thick stands grow on the more nearly level soils.

6. Vernon-Wichita Association

Gently sloping to sloping, deep and moderately deep soils that have a clay loam or silt loam surface layer and clay or silty clay loam lower layers

This association is dissected by many gullies and has well-defined drainageways. The major soils in this association formed in material weathered from red-bed clay and shale.

The Vernon-Wichita association covers about 10 percent of the county. Vernon soils make up about 20 percent of this association, Wichita soils 18 percent, and small percentages of many soils the remaining 62 percent.

Vernon soils are more sloping and rolling. They have a reddish-brown clay loam surface layer underlain by very firm clay.

Wichita soils are smoother and more uniform than the Vernon soils. They have a reddish-brown silt loam surface layer and subangular blocky, firm, silty clay loam lower layers.

Less extensive soils in this association are of the Berda, Cobb, Latom, Miles, Obaro, Olton, Polar, Quinlan, Spade, Weymouth, and Woodward series. Two land types, Badland and Rough broken land, also make up a part of this association.

Most of this association is in native range. Small areas are cultivated.

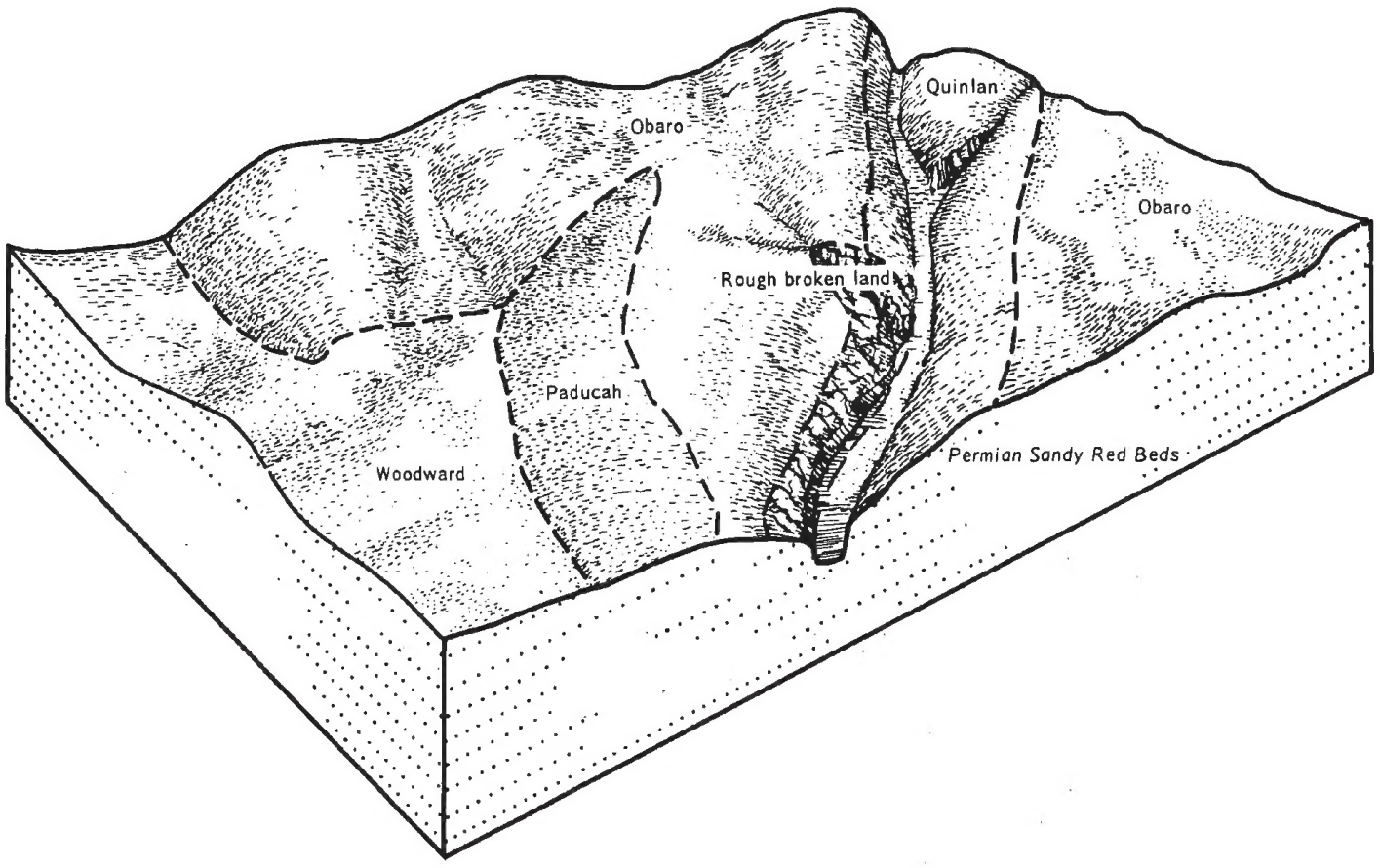


Figure 5.--Soil pattern in the Obaro-Paducah association

DESCRIPTIONS OF THE SOILS

This section describes the soil series and mapping units in Kent County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface down to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those for dry soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soi series. Rough broken land, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit, range site, wildlife group, or other interpretive group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (5).

Abilene Series

The Abilene series consists of deep, moderately slowly permeable soils of the uplands. These soils are smooth and nearly level and lie on broad high terraces or in valleys. They formed in calcareous alluvium or outwash deposits.

In a representative profile, the surface layer is dark grayish-brown clay loam about 7 inches thick. The next layer is brown clay loam in the upper 7 inches and firm brown clay in the lower 26 inches. The underlying material, extending to a depth of about 64 inches, is reddish-yellow clay loam.

Representative profile of Abilene clay loam, 0 to 1 percent slopes, in a cultivated field 100 feet east of a point that is 0.45 mile south of Farm Road 2320 and 0.5 mile east of intersection of Farm Roads 2320 and 948, which is about 7 miles north of Clairemont, Tex.

Ap--0 to 7 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak granular structure; hard, friable; neutral; abrupt, smooth boundary.

B1--7 to 14 inches, brown (10YR 4/3) clay loam, dark brown (10YR 3/3) when moist; compound moderate, medium, subangular blocky structure and granular structure; hard, friable; an estimated 10 percent is worm casts and fine pores; mildly alkaline; gradual, smooth boundary.

B21t--14 to 26 inches, brown (10YR 4/3) clay, brown (10YR 3/3) when moist; moderate, medium, blocky structure; very hard, firm; distinct clay films; an estimated 5 percent is fine pores and worm casts; mildly alkaline; gradual, smooth boundary.

B22t--26 to 40 inches, brown (10YR 5/3) clay, brown (10YR 4/3) when moist; moderate, medium, blocky structure; very hard, firm; distinct clay films; a few films and threads of calcium carbonate on surface of peds; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca--40 to 52 inches, reddish-yellow (7.5YR 7/6) clay loam, reddish yellow (7.5YR 6/6) when moist; structureless; an estimated 15 percent, by volume, segregated soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C2--52 to 64 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; structureless; calcareous old alluvium.

The A horizon ranges from 5 to 10 inches in thickness and from brown to dark grayish brown in color. The B1 horizon ranges from 5 to 10 inches in thickness and has the same color range as the A horizon. The B2t horizon is 16 to 50 inches thick, very dark grayish brown to brown and reddish brown in color, and from moderate to strong, fine and medium, subangular blocky to blocky in structure. The Cca horizon is pink or white to reddish yellow and contains an estimated 15 to 50 percent calcium carbonate.

Abilene clay loam, 0 to 1 percent slopes (AbA).--This nearly level soil is mainly in broad smooth areas that range from 20 to several hundred acres in size but are dominantly about 100 acres. Slopes are mainly less than 0.5 percent.

Included in mapped areas of this soil are small areas that have a loam surface layer. These areas make up about 10 percent of the mapping unit, and small areas of Miles and Olton soils make up 5 percent. In some places, this Abilene clay loam is calcareous throughout. A few areas, less than 15 acres in size, have slopes of as much as 1.5 percent.

Where water concentrates, small gullies as much as 2 feet deep and 6 feet wide occur at intervals of about 1,000 feet.

Almost half of the acreage of this Abilene clay loam is cultivated. The rest is mostly in range. This soil has a high available water capacity. Capability unit IIce-4; Deep Hardland range site.

TABLE 1.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Soil	Area	Extent	Soil	Area	Extent
	Acres	Percent		Acres	Percent
Abilene clay loam, 0 to 1 percent slopes	11,083	1.9	Obaro loam, 1 to 3 percent slopes	15,194	2.6
Berda fine sandy loam, 0 to 1 percent slopes	3,281	.6	Obaro loam, 3 to 5 percent slopes	18,279	3.2
Berda fine sandy loam, 1 to 3 percent slopes	9,288	1.6	Olton clay loam, 0 to 1 percent slopes	8,683	1.5
Berda fine sandy loam, 3 to 5 percent slopes	12,776	2.2	Olton clay loam, 1 to 3 percent slopes	49,458	8.6
Breaks and Yahola soils	7,108	1.2	Paducah loam, 1 to 3 percent slopes	7,137	1.2
Brownfield and Tivoli soils, undulating	2,937	.5	Polar gravelly loam, undulating	756	.1
Clairemont silt loam	5,166	.9	Polar and Berda soils, hilly	14,437	2.5
Clairemont and Yahola soils, frequently flooded	2,334	.4	Quinlan soils, sloping	66,174	11.7
Cobb and Miles fine sandy loams, 1 to 3 percent slopes	13,749	2.4	Randall clay	301	(1/)
Cobb and Miles fine sandy loams, 3 to 5 percent slopes	4,320	.8	Rough broken land	29,280	5.1
Cottonwood soils	1,701	.3	Spade fine sandy loam, 1 to 3 percent slopes	648	.1
Enterprise very fine sandy loam, 1 to 3 percent slopes	606	.1	Spade fine sandy loam, 3 to 5 percent slopes	6,899	1.2
Frio clay loam	2,970	.5	Springer loamy fine sand, 0 to 3 percent slopes	6,781	1.2
Latom soils, rolling	3,917	.7	Springer loamy fine sand, 3 to 8 percent slopes	2,539	.4
Lincoln soils	6,387	1.1	Tivoli fine sand	3,289	.6
Mangum clay	694	.11	Vernon soils, sloping	11,459	2.0
Miles fine sandy loam, 0 to 1 percent slopes	6,532	1.1	Vernon-Badland complex, sloping	5,115	.9
Miles fine sandy loam, 1 to 3 percent slopes	21,631	3.8	Weymouth clay loam, 1 to 3 percent slopes	9,699	1.7
Miles fine sandy loam, 3 to 5 percent slopes	5,898	1.0	Weymouth clay loam, 3 to 5 percent slopes	5,696	1.0
Miles loamy fine sand, 0 to 3 percent slopes	23,207	4.0	Wichita silt loam, 1 to 3 percent slopes	8,090	1.4
Miles loamy fine sand, 3 to 8 percent slopes	2,610	.5	Wichita silt loam, 3 to 5 percent slopes	3,729	.7
Miles soils, 2 to 6 percent slopes, eroded	1,100	.2	Woodward and Quinlan loams, sloping	38,274	6.6
Nobscot and Brownfield soils	92,062	16.1	Yahola very fine sandy loam	9,069	1.6
Nobscot and Tivoli soils, undulating	857	.2	Total land area of county	563,200	98.1
			Stream channels and water	14,080	1.9
			Total area in county	577,280	100.0

1/ Less than 0.1 percent.

Berda Series

The Berda series consists of deep, moderately permeable, friable soils that are gently sloping and gently rolling. These soils formed in material washed from higher lying soils. They are on alluvial fans and foot slopes and follow the slope contours.

In a representative profile, the surface layer is reddish-brown fine sandy loam about 12 inches thick. The next layer is light reddish-brown, friable sandy clay loam about 24 inches thick. The underlying material, extending to a depth of about 60 inches, is light reddish-brown fine sandy loam.

Representative profile of Berda fine sandy loam, 3 to 5 percent slopes, in range 200 feet west of a point on Farm Road 948 that is 0.1 mile north of the north end of the Brazos River bridge. The bridge is about 3 miles north of Clairemont, Tex.

A1--0 to 12 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak granular structure; slightly hard, friable; many worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B--12 to 36 inches, light reddish-brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) when moist; compound weak prismatic and weak granular structure; hard, friable; many worm casts; films and threads of calcium carbonate, calcareous; moderately alkaline; diffuse, wavy boundary.

C--36 to 60 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) when moist; structureless; slightly hard, very friable; few worm casts; calcareous; moderately alkaline.

The A horizon ranges from 6 to 14 inches in thickness and from reddish brown to light brown in color. Structure ranges from single grain or compound weak granular to subangular blocky and weak to moderate prismatic.

The B horizon is 8 to 28 inches thick and brown to reddish yellow. The structure of the B horizon is compound. It is weak to moderate, medium to coarse prismatic and weak to moderate granular or subangular blocky.

Depth to the C horizon is 18 to 40 inches. Visible calcium carbonate content of this horizon ranges from a few films and threads to 12 percent films, threads, and hard and soft masses.

Berda fine sandy loam, 0 to 1 percent slopes (BdA).--This nearly level soil is on benches along rivers and larger creeks. Soil areas range from 30 to 200 acres in size. Slopes are dominantly about 0.5 percent.

The surface layer is brown fine sandy loam about 10 inches thick. It is slightly hard when dry and very friable when moist, is noncalcareous, and is mildly alkaline.

The next layer, about 28 inches thick, is reddish-brown sandy clay loam that has compound weak, coarse, prismatic structure parting to weak, medium, granular structure. It is slightly hard and friable, has few films and threads of calcium carbonate, and is calcareous and moderately alkaline.

The underlying material, extending to a depth of about 60 inches, is reddish-yellow unconsolidated sandy clay loam that contains a few films and threads of calcium carbonate.

Included with this soil in mapping are small areas of Enterprise, Frio, Miles, and Yahola soils. Water erosion of nearby soils has left areas less than 5 acres in size where as much as 12 inches of sand covers the original surface. A small amount of this Berda fine sandy loam is noncalcareous in the B horizon.

Most of this Berda fine sandy loam, 0 to 1 percent slopes, is cultivated. It is well drained and is subject to a moderate hazard of soil blowing. Capability unit IIIe-4; Sandy Loam range site.

Berda fine sandy loam, 1 to 3 percent slopes (BdB).--This gently sloping soil is on the lower foot slopes below steeper areas of Berda, Miles, and Polar soils, and Rough broken land. Slopes are dominantly about 2 percent.

The surface layer is slightly hard, reddish-brown fine sandy loam that is very friable and about 14 inches thick. It is calcareous, is moderately alkaline, and has weak, medium, granular structure.

The next layer is hard, friable, light reddish-brown sandy clay loam about 24 inches thick. It has compound moderate, medium, prismatic structure parting to weak blocky structure. It is calcareous and moderately alkaline and has films and threads of calcium carbonate on the surface of peds.

The underlying material, extending to a depth of about 64 inches, is light reddish-brown, unconsolidated fine sandy loam that is structureless, calcareous, and moderately alkaline.

Included with this soil in mapping are areas of Miles and Springer soils, which make up about 10 percent of the acreage, and small areas of Yahola and Frio soils. Also mapped with this soil are areas that have a loam, sandy clay loam, or loamy fine sand surface layer. These areas make up about 8 percent of the acreage of this soil.

About 70 percent of the acreage of this Berda fine sandy loam is in native range. This soil is well drained; it is subject to a moderate hazard of soil blowing and a slight hazard of water erosion. Capability unit IIIe-5; Sandy Loam range site.

Berda fine sandy loam, 3 to 5 percent slopes (BdC).--This gently sloping soil is on benches and foot slopes along rivers and creeks. Slopes are dominantly about 4 percent. Soil areas are irregularly shaped but tend to be long and narrow.

This soil has the profile described as representative for the Berda series (pl. I, left).

Included with this soil in mapping are areas less than 5 acres in size that are 10 to 15 percent, by volume, quartzitic pebbles. About 15 percent of this unit is made up of a soil that has a sandy clay loam or loam surface layer. Also included are small areas of Miles and Obaro soils that make up about 10 percent of the unit. About 5 percent of the area is a soil that has lower layers of fine sandy loam.

Most of the acreage of this Berda fine sandy loam is in native range. This soil is moderately susceptible to soil blowing and water erosion. Capability unit IVe-9; Sandy Loam range site.

Breaks and Yahola Soils

Breaks and Yahola soils (Bk). This mapping unit is made up of Breaks, a land type, and Yahola soils. They are in long, narrow areas of 50 to 200 acres or more in size. These areas lie along winding intermittent drains. The Breaks border the drains, and the Yahola soils are in the bottoms of the drains. Both formed in material weathered from Permian packsand and sandstone.

The Breaks make up about 27 percent of this mapping unit. Their slopes are dominantly about 40 percent. Gypsum rims and caps are common in the higher parts of the landscape. Geologic erosion is active.

Yahola soils make up about 25 percent of this unit. These soils are nearly level to gently sloping. Their slopes are concave and dominantly less than 3 percent. Their surface layer is about 10 inches of soft, very friable, yellowish-red silty clay loam or very fine sandy loam. It has weak granular structure and is calcareous and moderately alkaline. Below the surface layer is reddish-yellow very fine sandy loam that is many feet thick. This material is soft, very friable, and calcareous and

moderately alkaline. It contains bedding planes and strata of fine sandy loam and loamy fine sand.

Included in this mapping unit are small, narrow areas of Woodward soils and Quinlan soils, above and below the Breaks. Also included are small areas of soil consisting of less than 10 inches of very fine sandy loam over gypsum, or over unweathered Permian packsand or soft sandstone. A small acreage of Clairemont soils is also included. Inclusions make up about 48 percent of this mapping unit.

The areas of this mapping unit are not cultivated, nor are any of them suitable for cultivation. Capability unit VIIs-1; Breaks in Rough Breaks range site, and Yahola soils in Loamy Bottomland range site.

Brownfield Series

The Brownfield series consists of deep, gently undulating, moderately permeable soils. They formed in sandy outwash or sandy wind-deposited material.

In a representative profile, the surface layer is brown fine sand about 7 inches thick. The next layer is 19 inches of pale-brown fine sand. Beneath this is a layer of friable reddish-yellow sandy clay loam about 22 inches thick. The next layer is reddish-yellow loamy fine sand that extends to a depth of 70 inches. Beneath this layer, and extending to a depth of 84 inches, is reddish-yellow fine sandy loam.

Representative profile of Brownfield fine sand, in an area of Nobscot and Brownfield soils, in range 100 feet east of Texas Highway 70, from a point 2.1 miles south of the intersection of Texas Highway 70 and U.S. Highway 380, which is about 1 mile south of Jayton, Tex.

A1--0 to 7 inches, brown (10YR 5/3) fine sand, dark brown (10YR 4/3) when moist; single grain; loose when dry or moist; slightly acid; gradual, smooth boundary.

A2--7 to 26 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; single grain; loose when dry or moist; slightly acid; gradual, smooth boundary.

B2t--26 to 48 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; compound weak subangular blocky and moderate, very coarse, prismatic structure; very hard, friable; continuous clay films on prisms; slightly acid; gradual, smooth boundary.

A'--48 to 70 inches, reddish-yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) when moist; structureless; few pockets of clean sand grains; noncalcareous; neutral; gradual, smooth boundary.

B'2t--70 to 84 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) when moist; sand grains show bridging and coatings of clay films; mildly alkaline.

The A1 horizon ranges from brown to reddish brown in color, and the A2 horizon is very pale brown to light reddish brown. The A horizon ranges from 20 to 40 inches in thickness and from neutral to slightly acid in reaction.

The B2t horizon ranges from 14 to 40 inches in thickness, from reddish brown to yellowish red or red in color, and from weak to moderate, fine, subangular blocky to coarse or very coarse prismatic in structure. The A' horizon is reddish brown to reddish yellow.

Brownfield and Tivoli soils, undulating (BtB).--Areas of this mapping unit are from 10 to 400 acres in size. Slopes are mainly less than 3 percent, but some small dunes have slopes as great as 15 percent. The surface soil has blown into hummocks or small dunes as much as 3 feet in height, but most hummocks are about 10 inches in height. The sandy clay loam lower layer is exposed in the wind-scoured areas near the dunes.

Brownfield soils make up about 37 percent of this mapping unit and occupy the smoother and less undulating acreage. This Brownfield soil has the profile described as representative for the series.

The Tivoli soils that make up about 25 percent of this unit are duned. In a representative profile of Tivoli soil, the surface layer is 4 inches of neutral, brown fine sand that is single grain and loose when dry and moist. Underlying this to a depth of about 60 inches is light-brown, neutral, unconsolidated fine sand.

Miles, Springer, and Nobscot soils cover about 15 percent of the mapping unit. A soil that is similar to Brownfield, except for having a surface layer less than 20 inches thick, makes up about 23 percent of the acreage.

The soils of this mapping unit are highly subject to soil blowing but are only slightly subject to water erosion. About 40 percent of this unit is cultivated; the rest is in range. Capability unit VIe-7; Deep Sand range site.

Clairemont Series

The Clairemont series consists of deep, nearly level, calcareous soils on bottom-land benches along rivers and larger creeks. These soils also are in broad to narrow overflow areas along small creeks.

In a representative profile, the surface layer is reddish-brown silt loam about 8 inches thick. The underlying material, extending to a depth of about 60 inches, is reddish-brown silty clay loam that contains thin strata of fine sandy loam, very fine sandy loam, and silt loam.

Representative profile of Clairemont silt loam in native range, 300 feet east and 50 feet north of the bridge across McKenzie Creek on Polar Road. This bridge is about 0.8 mile west of the intersection of Polar Road and Farm Road 1231, which is about 4.5 miles south of the intersection of Farm Road 1231 and U.S. Highway 380. This intersection is about 5 miles southwest of Clairemont, Tex.

A1--0 to 8 inches, reddish-brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) when moist; compound moderate, fine, granular and weak subangular blocky structure; hard, friable; few films and threads of calcium carbonate in the lower part; calcareous; moderately alkaline; gradual, smooth boundary.

C1--8 to 32 inches, reddish-brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) when moist; massive parting to blocky fragments that have dull faces; faint bedding planes evident; few worm casts; hard, friable; thin strata of very fine sandy loam and silt loam; few films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C2--32 to 60 inches, reddish-brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) when moist; massive parting to granular fragments that have dull faces; faint bedding planes evident; hard, friable; thin strata of fine sandy loam and silt loam; calcareous; moderately alkaline.

The A1 horizon ranges from brown to reddish brown in color and from 4 to 14 inches in thickness.

The C horizon ranges from reddish brown to light reddish brown in color and from silt loam to silty clay loam in texture. Bedding planes are faint to evident. Stratification with clay to sand is common below a depth of 3 feet.

Clairemont silt loam (Ca).--This nearly level soil occupies benches adjacent to the rivers and creeks. The areas of this soil are 20 to 40 feet above river or creek beds and 15 to more than 100 acres in size. They are long and relatively narrow, as they parallel the river or creek. Slopes are dominantly less than 0.5 percent but range to 1 percent in places.

This Clairemont soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Yahola very fine sandy loam less than 10 acres in size. Also included are areas less than 5 acres in size that have a surface of fine sandy loam, silty clay loam, or clay. These inclusions make up about 15 percent of the acreage.

Most of this Clairemont silt loam is in range, but some is cultivated and, where practicable, is irrigated. The hazards of soil blowing and water erosion are slight. This soil is occasionally flooded, either by overflow from a creek or river or by runoff from higher lying soils. Capability unit IIce-1; Loamy Bottomland range site.

Clairemont and Yahola soils, frequently flooded (Cf).--This mapping unit consists of deep, nearly level soils in narrow flood plains, 50 to 500 feet wide. These soils formed in recent alluvial material that was washed from higher lying soils. Although the soils in these areas are subject to frequent flooding, the water quickly recedes and causes little damage to permanent vegetation. Most areas are cut by meandering stream channels. Some areas are dominantly Clairemont soil, and others are dominantly Yahola soil. Average composition of this mapping unit is Clairemont 50 percent, Yahola 30 percent, and other soils, such as Frio and Lincoln, 20 percent.

The surface layer of the Clairemont soil is yellowish-red very fine sandy loam or clay loam about 5 inches thick. It has weak subangular blocky structure and is slightly hard, friable, calcareous, and moderately alkaline. The underlying material, extending to a depth of about 80 inches, is reddish-yellow, unconsolidated sandy clay loam and silty clay loam stratified with fine sandy loam, loam, and silt loam.

The surface layer of the Yahola soil is reddish-brown, soft, very friable very fine sandy loam about 15 inches thick. It has weak granular structure and is calcareous and moderately alkaline. The underlying material, extending to a depth of about 80 inches, is reddish-yellow, unconsolidated fine sandy loam stratified with very fine sandy loam, silt loam, and loamy fine sand.

Included in this mapping unit are areas of Berda, Frio, and Lincoln soils. They make up about 20 percent of the unit.

All of the acreage of this mapping unit is in native range. Capability unit Vw-1; Loamy Bottomland range site.

Cobb Series

The Cobb series consists of moderately deep soils underlain by soft to hard sandstone.

In a representative profile, the surface layer is dark-brown fine sandy loam about 8 inches thick. Next is a 34-inch layer consisting of the following: 19 inches of reddish-brown, firm sandy clay loam; 9 inches of yellowish-red, firm sandy clay loam; and 6 inches of reddish-brown, friable sandy clay loam. Below this, and extending to a depth of 50 inches, is light-brown, partially weathered, coarse sandstone.

Representative profile of Cobb fine sandy loam, in an area of Cobb and Miles fine sandy loam, 1 to 3 percent slopes, 200 feet east of a ranch road, from a point that is 3.3 miles northeast on the ranch road from its intersection with Farm Road 1142, which is 4.15 miles south on Farm Road 1142 from the old Polar School.

A1--0 to 8 inches, dark-brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) when moist; weak subangular blocky structure; slightly hard, friable; neutral; clear, smooth boundary.

B21t--8 to 27 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; few worm casts; common pores; few quartz pebbles; distinct patchy clay films; neutral; gradual, smooth boundary.

B22t--27 to 36 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; few worm casts; common pores; few quartz pebbles; distinct patchy clay films; neutral; gradual, smooth boundary.

B3t--36 to 42 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; compound moderate, coarse, prismatic

structure parting to weak subangular blocky; slightly hard, friable; common pores; common small quartz pebbles; few magnesium or iron concretions; mildly alkaline; clear, wavy boundary.

R--42 to 50 inches, light-brown, partially weathered, coarse sandstone having some calcium carbonate on the upper surfaces and in the cracks and crevices.

The A horizon ranges from reddish brown to brown in color and from 4 to 10 inches in thickness.

The B2t horizon ranges from reddish brown to yellowish red in color, from 12 to 35 inches in thickness, and from weak to moderate prismatic and weak to moderate subangular blocky in structure.

The B3 horizon is reddish brown to reddish yellow and from 0 to 10 inches thick. Texture ranges from fine sandy loam to sandy clay loam.

The R layer is red to gray and is at a depth of 20 to 48 inches. This layer ranges from soft, partially weathered sandstone to hard, unaltered sandstone.

Cobb and Miles fine sandy loams, 1 to 3 percent slopes (CmB).--Areas of this mapping unit range from 20 to 1,000 acres in size. Slopes are dominantly about 2 percent.

The Cobb soil makes up about 50 percent of this mapping unit, the Miles soil about 29 percent, and inclusions of other soils 21 percent. This Cobb soil has the profile described as representative for the Cobb series.

The surface layer of the Miles soil is slightly hard and about 8 inches thick. It is dark-brown, friable fine sandy loam that has weak subangular blocky structure and is neutral.

The next layer is reddish-brown or yellowish-red sandy clay loam about 54 inches thick that has compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky. It is very hard and firm, has common patchy clay films, and is mildly alkaline.

The underlying material, below a depth of about 62 inches, is reddish soft to hard sandstone.

Included in this mapping unit are areas of Spade and Latom soils on small knobs, small areas of Weymouth and Vernon soils, and areas of Olton soils. Another inclusion is a soil similar to Miles but underlain by sandstone at depths between 48 and 60 inches.

A few small areas of this mapping unit are cultivated. Most of the acreage is in range. In cultivated fields, soil blowing has resulted in the formation of small dunes along fence rows. Capability unit IIIe-4; Sandy Loam range site.

Cobb and Miles fine sandy loams, 3 to 5 percent slopes (CmC).--Areas of this mapping unit are gently sloping and range from 15 to 500 or more acres in size. Slopes are dominantly about 4.5 percent.

The Cobb soil covers about 55 percent of this mapping unit; Miles soil, about 35 percent; and inclusions of other soils, 10 percent.

The surface layer of the Cobb soil is reddish-brown fine sandy loam about 7 inches thick that has weak subangular blocky structure. It is slightly hard, friable, and slightly acid.

The next layer is reddish-brown sandy clay loam, about 33 inches thick, that has compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure. It is hard and firm, is noncalcareous to calcareous, is mildly to moderately alkaline, and contains a few quartz pebbles and distinct patchy clay films.

The underlying material is soft and slightly hard sandstone.

The Miles soil has a surface layer of dark-brown sandy clay loam about 8 inches thick that has weak subangular blocky structure. It is slightly hard, friable, and neutral.

The next layer is reddish-brown to yellowish-red sandy clay loam about 56 inches thick that has compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky structure. It is hard and firm and contains common patchy clay films. It is noncalcareous and mildly alkaline.

The underlying material, below a depth of about 64 inches, is reddish, soft to hard, partially weathered sandstone.

Included in this mapping unit are Latom, Spade, Vernon, and Weymouth soils on small knobs and ridges and a soil similar to Miles but underlain by sandstone at depths between 48 and 60 inches.

The Cobb and Miles soils are subject to a moderate hazard of soil blowing and water erosion. Most of this mapping unit is in range; the rest is cultivated. Sheet erosion has thinned the surface soil in places, and gullies have formed in both cultivated areas and in range, especially down old trails and roads. Capability unit IVe-4; Sandy Loam range site.

Cottonwood Series

The Cottonwood series consists of very shallow, nearly level to gently sloping soils over gypsum. These soils lie above small drains in scattered areas of the county.

In a representative profile, the surface layer is brown loam about 6 inches thick. The underlying material, extending to a depth of about 60 inches, is hard white material that is mainly gypsum.

Representative profile of Cottonwood loam, in an area of Cottonwood soils, in range 0.25 mile east of Farm Road 948, from a point that is 1.3 miles south on Farm Road 948 from its intersection with Farm Road 643.

A1--0 to 6 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; moderate, fine, subangular blocky structure; slightly hard, friable; an estimated 20 percent worm casts; calcareous; moderately alkaline; abrupt, wavy boundary.

C--6 to 60 inches, white (10YR 8/1), hard material that is mainly gypsum that can be dug with a spade and broken by hand; calcareous and moderately alkaline.

The A horizon ranges from brown to light yellowish brown in color and from 3 to 10 inches in thickness. Texture of the A horizon is loam or clay loam. The C horizon ranges from white to mottled white and brown. This horizon is weakly to strongly consolidated impure gypsum and is calcareous to noncalcareous.

Cottonwood soils (Co).--These soils lie on upland flats along drains. Soil areas are mostly long and narrow and less than 50 acres in size, but some areas are as much as 100 acres in size. Slopes range from about 0.2 to 3 percent.

Included with these soils in mapping are areas of Abilene soils that make up about 10 percent of the acreage. Some local areas have gypsum exposed on the surface. Sinkholes or small holes less than 20 feet in diameter and less than 6 feet deep are common in these soils. Some areas contain as much as 15 percent of soils that are deeper than 10 inches to gypsum.

Most areas of Cottonwood soils are used as range. Forage production is limited by the very shallow depth of the soils and their high gypsum content. Capability unit VIIs-1; Gypland range site.

Enterprise Series

The Enterprise series consists of nearly level to gently sloping soils on uplands. These soils are deep and friable.

In a representative profile, the surface layer is reddish-brown very fine sandy loam about 8 inches thick. The next layer is very friable, yellowish-red very fine sandy loam about 28 inches thick. The underlying material, extending to a depth of about 64 inches, is yellowish-red very fine sandy loam.

Representative profile of Enterprise very fine sandy loam, 1 to 3 percent slopes, in a cultivated field, 0.2 mile north across Short Croton Creek from a county road. This point on the county road is 3.75 miles east of the intersection of the county road and Texas Highway 70. This intersection is 2.1 miles northwest on Texas Highway 70 from its intersection with Farm Road 1228 on the edge of Jayton, Tex.

Ap--0 to 8 inches, reddish-brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) when moist; structureless; slightly hard, very friable; mildly alkaline; abrupt, smooth boundary.

B--8 to 36 inches, yellowish-red (5YR 5/6) very fine sandy loam, reddish brown (5YR 5/5) when moist; compound weak prismatic parting to weak subangular blocky structure; soft, very friable; many worm casts; many fine pores; calcareous; moderately alkaline below a depth of 26 inches; gradual, smooth boundary.

C--36 to 64 inches, yellowish-red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) when moist; structureless; few films and threads of calcium carbonate.

The A horizon ranges from reddish brown to light brown in color and from 6 to 20 inches in thickness. The B horizon ranges from reddish brown to reddish yellow in color and from 20 to 36 inches in thickness. Structure ranges from weak and moderate, coarse, prismatic to weak and moderate subangular blocky, or is a compound of the two. The C horizon is reddish brown, reddish yellow, or yellowish red.

Enterprise very fine sandy loam, 1 to 3 percent slopes (EnB).--This soil lies along creeks mostly between areas of Yahola soils and areas of Woodward and Quinlan soils. Soil areas are irregular and range from 15 to 150 acres in size. The longer axis of most areas roughly parallels the creek.

Mapped with this soil are small areas of Quinlan, Woodward, and Yahola soils. Some areas on the smoother slopes have inclusions of a soil similar to Enterprise, but texture of the surface layer is silt loam or loam.

Less than 40 percent of this Enterprise soil is cultivated, although it is well drained and easily tilled. This soil is slightly susceptible to soil blowing and water erosion. Capability unit IIe-1; Mixedland range site.

Frio Series

The Frio series consists of deep, nearly level soils on bottom lands. These soils lie on the flood plains of the rivers and major creeks. Most areas of this soil are subject to overflow every few years. These overflows are of short duration and do not severely damage crops or native vegetation.

In a representative profile, the surface layer is clay loam about 26 inches thick. The upper 6 inches is dark brown; the next 8 inches, brown; and the lower 12 inches, reddish brown. The next layer, about 22 inches thick, is reddish-brown firm clay loam. The underlying material, extending to a depth of about 64 inches, is reddish-brown clay loam.

Representative profile of Frio clay loam, in range 150 feet east of Farm Road 948, from a point that is 0.7 mile north of the north end of the Brazos River bridge on Farm Road 948, north of Clairemont, Tex.

A11--0 to 6 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, firm; many worm casts; common pores; calcareous; moderately alkaline; gradual, smooth boundary.

A12--6 to 14 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, firm; common worm casts; common fine pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

A13--14 to 26 inches, reddish-brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/3) when moist; compound moderate, coarse, prismatic

structure parting to moderate, fine subangular blocky; hard, firm; common worm casts; common fine pores; common films and threads of calcium carbonate; calcareous, moderately alkaline; gradual, smooth boundary.

B--26 to 48 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; compound moderate, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, firm; common worm casts; common fine pores; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C--48 to 64 inches, reddish-brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) when moist; structureless; stratified with layers of clay loam, silty clay loam, and sandy clay loam; films and threads of calcium carbonate.

The A horizon ranges from reddish brown to brown in color; from 20 to 30 inches in thickness; and from moderate, medium, granular to subangular blocky in structure. The B horizon ranges from reddish brown to light yellowish brown in color; from 20 to 50 inches in thickness; and from moderate, medium, granular to moderate, fine and medium, subangular blocky in structure. Depth to the C horizon is 40 to 70 inches.

Frio clay loam (Fr).--This nearly level soil is on the flood plains of creeks and rivers. It also occupies abandoned river channels. Soil areas range from 15 to 100 acres in size. Slopes are dominantly less than 0.5 percent but range to 1 percent.

Mapped with this soil are areas of Abilene, Berda, Clairemont, and Yahola soils that make up about 10 percent of the acreage. Also included are local areas along the rivers that are slightly saline.

About 95 percent of this Frio clay loam is in range, since most of the areas are within large ranches. This soil is slightly susceptible to soil blowing and water erosion. Capability unit IIce-1; Loamy Bottomland range site.

Latom Series

The Latom series consists of very shallow to shallow, gravelly soils that formed in material weathered from conglomerate rocks consisting of quartzitic pebbles and sandstone. These soils are on ridges and knolls.

In a representative profile, the surface layer is brown gravelly sandy loam about 8 inches thick. Below this, extending to a depth of more than 12 inches, is indurated conglomerate rock.

Representative profile of Latom gravelly sandy loam, in an area of Latom soils, rolling, 0.2 mile east of a private road, from a point on the private road that is 0.6 mile north of the junction of the private road and U.S. Highway 380. This junction is 3.5 miles west of the intersection of U.S. Highway 380 and Farm Road 1231, which is about 5 miles west of Clairemont, Tex.

A1--0 to 8 inches, brown (7.5YR 5/4) gravelly sandy loam, dark brown (7.5YR 3/4) when moist; weak granular structure; slightly hard, friable; an estimated 30 percent, by volume, quartzitic pebbles and sandstone fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

R--8 to 12 inches, indurated conglomerate rock made up of quartzitic pebbles and sandstone; calcium carbonate coatings in crevices.

The A horizon ranges from reddish brown to pale brown in color and from 4 to 20 inches in thickness. Texture is gravelly sandy loam or fine sandy loam. Quartz pebbles and sandstone fragments on the surface and in the A horizon range from 0 to as much as 35 percent of the soil. The R layer ranges from hard sandstone to sandy conglomerate.

Latom soils, rolling (LaC).--The areas of these soils range from 5 to 200 acres in size. Most areas are irregularly oval shaped, but some are long and narrow. Slopes are dominantly about 5 percent but range from 2 to 12 percent.

Included with these soils in mapping are local areas of rock outcrop that occupy less than an acre and make up about 20 percent of the acreage. Areas of Spade soils cover about 10 percent of the acreage. Also included are areas of Berda, Cobb, and Weymouth soils that are less than 5 acres in size and a few steep areas of Rough broken land.

All of these Latom soils are in range. They are too shallow and too gravelly for cultivation. Capability unit VIIs-1; Very Shallow range site.

Lincoln Series

The Lincoln series consists of deep soils of the flood plains (pl. 1, right). These soils formed in sandy alluvium along rivers and creeks.

Located only a few feet above the river or stream channel, these soils are subject to recurrent flooding and deposition of fresh soil material.

In a representative profile, the surface layer is pale-brown fine sand about 15 inches thick. The underlying material, extending to a depth of about 60 inches, is light yellowish-brown, stratified fine sand and loamy fine sand.

Representative profile of Lincoln fine sand, in an area of Lincoln soils, on the western edge of the Brazos River about 4.5 miles west on a county road from the intersection of the county road, Farm Road 948, and Farm Road 2320. This intersection is about 7 miles north of Clairemont, Tex.

A1--0 to 15 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; single grain; loose when dry or moist; calcareous; moderately alkaline; gradual, smooth boundary.

C--15 to 60 inches, light yellowish-brown (10YR 6/4) stratified fine sand and loamy fine sand, yellowish brown (10YR 5/4) when moist; single grain; loose when dry or moist; calcareous; moderately alkaline; evident bedding planes

and 0.5- inch to 12-inch strata that have textures ranging from fine sandy loam to coarse sand.

The A horizon ranges from reddish brown to yellowish brown in color and from 8 to 15 inches in thickness. The C horizon ranges from light reddish brown to very pale brown in color and contains strata of silt loam, silty clay loam, or gravel. Texture throughout the soil ranges from sand to loamy fine sand.

Lincoln soils (Ln).--Areas of these nearly level soils are mainly irregularly crescent shaped and range from 10 to 150 acres in size. These areas are mostly near a bend in a river or creek and, in places, are undulating and duned. Slopes are mainly less than 1 percent but range to as much as 5 percent.

Mapped with these soils are areas of Clairemont and Yahola soils that account for about 10 percent of the acreage and duned Tivoli soils that form about 5 percent.

Most areas of these Lincoln soils are in range, but a few small areas have been planted to improved pasture grasses. These soils are highly subject to soil blowing. Small blowout areas and low dunes indicate that soil blowing occurs even under native vegetation. Capability unit Vw-2; Sandy Bottomland range site.

Mangum Series

The Mangum series consists of deep clayey soils on bottom lands. Located in the flood plains of the major rivers, these soils are subject to flooding at intervals of once a year to once in 5 years.

In a representative profile, the surface layer is brown clay about 8 inches thick. The underlying material, extending to a depth of about 60 inches, is clay. The upper 8 inches of this layer is brown, and the lower 44 inches is reddish brown.

Representative profile of Mangum clay, 310 feet south of a private road, from a point on the private road that is 0.2 mile east of its intersection with Farm Road 1081. This intersection is 0.75 mile north of the north end of the Brazos River bridge on Farm Road 1081, about 12 miles northwest of Clairemont, Tex.

A1--0 to 8 inches, brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; weak subangular blocky structure; very hard, sticky and plastic; calcareous; moderately alkaline; clear, smooth boundary.

C1--8 to 16 inches, brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) when moist; massive; very hard, sticky and plastic; few slick faces; calcareous; moderately alkaline; gradual, smooth boundary.

C2--16 to 38 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; massive; very hard, sticky and plastic; few gypsum and salt crystals; calcareous; moderately alkaline; clear, wavy boundary.

C3--38 to 60 inches, reddish-brown clay; structureless; evident bedding planes; thin strata of fine sandy loam, silt loam, and loamy sand; common gypsum and salt crystals.

The A horizon ranges from brown to yellowish brown in color and from 6 to 10 inches in thickness.

The C horizon ranges from reddish brown to dark brown. Clay content between depths of 10 and 40 inches ranges from 40 to 50 percent.

Mangum clay (Ma).--This nearly level soil lies along major rivers in irregularly shaped areas mostly less than 80 acres in size. Soil areas range in size from 5 to 200 acres, and some areas have small depressions and humps.

Mapped with this soil are areas of Clairemont and Frio soils that make up about 15 percent of the acreage.

This Mangum clay has a water table that is 4 to 15 feet below the surface.

Most of this soil is not well suited to cultivation because it is subject to flooding and is droughty. About 85 percent of this Mangum clay is in range. Capability unit IIIs-2; Clay Flats range site.

Miles Series

The Miles series consists of deep, friable soils that are moderately permeable and well drained. These soils formed in sandy outwash or old alluvium. They are nearly level to sloping and lie on uplands.

In a representative profile, the surface layer is brown fine sandy loam about 10 inches thick. Underlying this is friable sandy clay loam about 70 inches thick. The upper 6 inches is reddish brown; the next 54 inches is yellowish red; and the lower 10 inches is pink. The underlying material, extending to a depth of about 90 inches, is reddish-yellow fine sandy loam.

Representative profile of Miles fine sandy loam, 1 to 3 percent slopes, in a pasture 100 yards northwest of the intersection of Texas Highway 70 and Farm Road 1228, which is 1 mile north of Jayton, Tex.

A1--0 to 10 inches, brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, friable; neutral; gradual, smooth boundary.

B1--10 to 16 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; few fine pores; neutral; gradual, smooth boundary.

B21t--16 to 35 inches, yellowish-red (5YR 4/6) sandy clay loam, yellowish red (5YR 3/6) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular

blocky; very hard, friable; few medium pores; thin patchy clay films on ped faces; neutral in upper part, mildly alkaline in lower part; gradual, smooth boundary.

B22t--35 to 55 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable; few very fine pores; clay films; few soft concretions and threads of calcium carbonate; moderately alkaline; gradual, smooth boundary.

B23t--55 to 70 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to weak, medium subangular blocky; hard, friable; upper part has pockets of clean sand grains, 2 to 5 millimeters in diameter, in a matrix of bridged and coated sand grains; films, threads, and soft masses of calcium carbonate in lower part; calcareous; moderately alkaline; gradual, smooth boundary.

B3ca--70 to 80 inches, pink (5YR 7/4) sandy clay loam, light reddish brown (5YR 6/4) when moist; weak, coarse, prismatic structure; friable; 5 to 10 percent, by volume, whitish, friable and slightly cemented masses of calcium carbonate; calcareous; moderately alkaline; diffuse, lower boundary.

C--80 to 90 inches, reddish-yellow (5YR 7/6) fine sandy loam, reddish yellow (5YR 6/6) when moist; structureless; massive; friable; porous; a few soft lumps and concretions of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from light brown to reddish brown in color and from 6 to 16 inches in thickness. Texture is fine sandy loam, sandy clay loam, or loamy fine sand.

The Bt horizon ranges from reddish brown to red in color. Structure is compound from weak to moderate, fine and medium, subangular blocky to weak or moderate, coarse or very coarse, prismatic.

The B3 horizon is reddish brown to red in color and from loamy fine sand to sandy clay loam in texture. Pockets and lenses of stripped sand grains range from none to common.

The C horizon is loamy sand to fine sandy loam. Depth to this horizon is 60 to 90 inches.

Miles fine sandy loam, 0 to 1 percent slopes (MnA).--This nearly level soil is on smooth uplands. Soil areas are dominantly oval and 100 acres in size, but they range from 10 to 500 acres. Most areas more than 100 acres in size are irregularly shaped. The dominant slope of these areas is about 0.6 percent.

The surface layer in a representative profile is about 10 inches of brown fine sandy loam that is structureless, slightly hard and friable, and mildly alkaline.

The next layer is reddish-brown sandy clay loam about 70 inches thick. It has compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky. This layer is very hard, friable, calcareous, and moderately alkaline and has patchy clay films in the upper part.

The underlying material, extending to a depth of about 90 inches, is reddish-yellow unconsolidated fine sandy loam containing soft lumps and concretions of calcium carbonate.

Mapped with this soil are areas of Olton and Abilene soils that make up about 10 percent of the acreage. Also included are small areas that have a loam or sandy clay loam surface and small areas that have a loamy fine sand surface. The soils having the loamy fine sand surface layer make up less than 5 percent of the acreage.

About 75 percent of this Miles fine sandy loam is cultivated. This soil is moderately subject to soil blowing. Capability unit IIIe-4; Sandy Loam range site.

Miles fine sandy loam, 1 to 3 percent slopes (MnB).--This gently sloping soil is on uplands in areas that range from 30 to more than 1,000 acres in size. Slopes are dominantly 1.7 percent.

This soil has the profile described as representative for the Miles series.

Included with this soil in mapping are areas of Olton and Paducah soils that make up about 10 percent of the acreage and areas of Obaro and Spade soils less than 5 acres in size that make up another 5 percent. Another inclusion is small areas of a soil that has a surface layer of loam or loamy fine sand.

About 55 percent of this Miles fine sandy loam is in native range. This soil is moderately susceptible to soil blowing and slightly susceptible to water erosion. In cultivated areas, soil blowing has formed sand dunes 1 to 4 feet high and 4 to 40 feet wide along fence rows. Winnowing of 30 percent of the surface soil in cultivated areas has resulted in a surface that is 2 to 4 inches of loamy fine sand. In some fields, water erosion has cut gullies about 1 foot deep and as much as 8 feet wide at intervals of 300 to 600 feet. Capability unit IIIe-4; Sandy Loam range site.

Miles fine sandy loam, 3 to 5 percent slopes (MnC).--This gently sloping soil is in irregular areas that range from 10 to more than 100 acres in size. Slopes are dominantly about 4 percent.

In a representative profile, the surface layer is brown fine sandy loam about 6 inches thick. It has weak granular structure and is soft, very friable, and neutral.

The next layer is reddish-brown sandy clay loam about 58 inches thick. It has compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky. It is hard, friable, and mildly alkaline and has patchy clay films in the upper part.

The underlying material, extending to a depth of about 80 inches, is calcareous, unconsolidated material that is reddish and sandy.

Mapped with this soil are areas of Cobb, Spade, and Weymouth soils that cover about 10 percent of

the acreage. Small areas of Obaro soils make up as much as 20 percent of some mapped areas but only 5 percent of the total acreage.

About 85 percent of this Miles fine sandy loam is in native range. This soil is moderately susceptible to soil blowing and water erosion. In some areas gullies as much as 18 inches deep and 12 feet wide occur at intervals of 200 to 500 feet. Soil blowing has formed dunes along fence rows in some cultivated fields. Capability unit IVe-4; Sandy Loam range site.

Miles loamy fine sand, 0 to 3 percent slopes (MlB).--This nearly level to gently sloping soil is associated with the Nobscot and Brownfield soils. Areas of this soil range from 20 to nearly 1,000 acres in size and have a dominant slope of about 1.2 percent.

In a representative profile, the surface layer is neutral, brown loamy fine sand 16 inches thick. It is single grain, loose, and soft.

The next layer is reddish-brown sandy clay loam about 44 inches thick. It has compound moderate, very coarse, prismatic structure parting to moderate, medium, subangular blocky. It is hard, friable, and mildly alkaline and has distinct patchy clay films in the upper part.

The underlying material, extending to a depth of about 80 inches, is unconsolidated, red, mildly alkaline fine sandy loam (pl. II, left).

Included with this soil in mapping are small areas of Brownfield and Springer soils that make up about 10 percent of the average mapped area. Also included are a few areas that are calcareous to the surface and are underlain by gypsum.

About 50 percent of this Miles loamy fine sand is cultivated. This soil is highly subject to soil blowing but only slightly subject to water erosion. In cultivated areas, soil blowing has formed dunes 2 to 8 feet high, and 8 to 20 feet wide at the base, along fences. Capability unit IVe-6; Sandyland range site.

Miles loamy fine sand, 3 to 8 percent slopes (MlD).--This soil has convex slopes that are dominantly about 6 percent. Some soil areas are irregularly shaped, but most are long and narrow. Most areas are about 50 acres in size but range from 10 to 200 acres.

In a representative profile, the surface layer is brown loamy fine sand about 13 inches thick. It is single grain, loose, soft, and neutral.

The next layer is reddish-brown sandy clay loam about 47 inches thick that has compound moderate, coarse, prismatic structure parting to weak subangular blocky. It is hard, friable, and mildly alkaline and has common patchy clay films in the upper part.

The underlying material, extending to a depth of about 80 inches, is reddish-yellow, unconsolidated loamy fine sand that has mottles of very pale brown.

Mapped with this soil are areas of Springer loamy fine sand that form about 15 percent of the acreage. About 10 percent is made up of a soil that has a thicker surface layer than normal for the Miles series. Inclusions of Miles fine sandy loam, Brownfield fine sand, and Nobscot fine sand form another 5 percent.

Most of this Miles loamy fine sand is in range. This soil is highly susceptible to water erosion and soil blowing in cultivated areas. In cultivated areas where runoff water accumulates, gullies as much as 2 feet deep and 5 to 10 feet wide occur at intervals of 300 to 600 feet. Capability unit VIe-6; Sandyland range site.

Miles soils, 2 to 6 percent slopes, eroded (MsC2).--Most of the acreage of these Miles soils is or has been cultivated. Soil areas are mostly less than 100 acres in size but range from 10 to 150 acres. Slopes are dominantly about 4 percent.

The surface layer of a representative profile is about 8 inches of reddish-brown fine sandy loam and sandy clay loam that has been mixed by plowing. It is massive, slightly hard, friable, and mildly alkaline.

The next layer is red sandy clay loam about 52 inches thick. It has a compound moderate, coarse, prismatic and moderate, medium, subangular blocky structure. It is hard, friable, and neutral and has patchy clay films.

The underlying material, extending to a depth of about 80 inches, is reddish, unconsolidated, sandy material.

Included with these soils in mapping are areas of Spade and Weymouth soils that make up about 10 percent of the acreage. Small areas of Springer and Brownfield soils also are included.

The surface layer of these Miles soils was originally fine sandy loam or loamy fine sand. Cultivation has mixed varying amounts of the sandy clay loam lower layers with the original surface, so that the present surface layer ranges from sandy clay loam to loamy fine sand in texture.

Sheet and gully erosion are common on these soils. Gullies as much as 3 feet deep and 12 to 15 feet wide commonly occur at 50 to 300 foot intervals. The winnowed surface and large sand dunes accumulated along fence rows show the effects of soil blowing. These dunes are 3 to 8 feet high and 8 to 25 feet wide at the base.

Erosion has removed the original surface from approximately 50 percent of the mapped areas. Sand dunes as much as 2 feet high and 5 to 15 feet wide at the base cover approximately 15 percent of the mapped area. In small areas along the lower slopes, water erosion has deposited 5 to 20 inches of stratified sandy material over the original surface.

These Miles soils are best suited to permanent grasses. Capability unit VIe-6; Sandy Loam range site.

Nobscot Series

The Nobscot series consists of deep, well-drained, sandy soils that formed in sandy materials that appear to be wind deposited. These hummocky

or gently undulating soils are on plains in undifferentiated units with Brownfield and Tivoli soils.

In a representative profile, the surface layer is grayish-brown fine sand about 7 inches thick. The next layer is light yellowish-brown fine sand about 27 inches thick. Beneath this is reddish-yellow fine sandy loam about 24 inches thick. The underlying material, extending to a depth of about 72 inches, is reddish-yellow fine sand.

Representative profile of Nobscot fine sand, in an area of Nobscot and Brownfield soils, 100 feet south of 90 degree bend to the east in ranch road 4.7 miles south of Clairemont, Tex. on county road that changes to ranch road.

A1--0 to 7 inches, grayish-brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry and moist; slightly acid; clear, smooth boundary.

A2--7 to 34 inches, light yellowish-brown (10YR 6/4) fine sand, yellowish-brown (10YR 5/4) when moist; single grain; loose when dry and moist; slightly acid; gradual, smooth boundary.

B2t--34 to 58 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 4/6) when moist; weak subangular blocky structure; soft when dry or moist; streaks and balls of clay; slightly acid; diffuse, wavy boundary.

C--58 to 72 inches, reddish-yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) when moist; single grain; loose when dry or moist; neutral.

The A horizon ranges from 20 to 40 inches in thickness. The A1 horizon ranges from brown to dark grayish brown in color. The A2 horizon is light yellowish brown, pale brown, or light brown. The B2t horizon is light red to yellowish red, and the C horizon is light red to reddish yellow.

Nobscot and Brownfield soils (Nb).--The gently undulating soils of this mapping unit lie on large plains. Slopes are mainly less than 3 percent, but small areas have slopes as much as 8 percent. The soils in this unit are so intermingled that it is not practical to separate them on the scale of map used in this survey. Topographic positions and kinds and amounts of vegetation are the same for these soils. Most representative areas of this unit contain several thousand acres. Some areas are dominantly Nobscot soils, and others are dominantly Brownfield soils.

The average composition of this unit is about 58 percent Nobscot soils, about 30 percent Brownfield soils, and about 12 percent inclusions of other soils

The Nobscot soil has the profile described as representative for the series.

In a representative profile of Brownfield fine sand, the surface layer is brown and pale-brown fine sand about 26 inches thick. It is loose when dry and moist and slightly acid.

The next layer is reddish-yellow sandy clay loam about 22 inches thick. It has compound moderate, very coarse, prismatic structure parting to weak subangular blocky. It is very hard, is friable, and has continuous clay films on prisms.

The underlying material, extending to a depth of about 64 inches, is reddish-yellow, unconsolidated, sandy material.

Small areas of Miles loamy fine sand and Springer loamy fine sand make up about 5 percent of this mapping unit. A few dunes of Tivoli fine sand less than 5 acres in size also are included.

Both Nobscot and Brownfield fine sand are highly susceptible to soil blowing. These soils are capable of supporting a good stand of tall grasses under native conditions.

More than 95 percent of this mapping unit is now used for range. Most formerly cultivated areas of this mapping unit are now abandoned and are overgrown with annual weeds or poor quality perennial grasses. Soil blowing is evident both in cultivated areas and in some areas of range. The erosion and shifting of the surface sand have resulted in large dunes along fence rows and small dunes and blowouts in fields. Capability unit VIe-7; Deep Sand range site.

Nobscot and Tivoli soils, undulating (NtB).--Cultivated or abandoned cropland makes up the predominant part of this mapping unit. Areas of this unit range from 15 to 200 acres in size. These areas are associated with other Nobscot soils and with Brownfield soils. The surface is wind-drifted fine sand in hummocks or small dunes. These formations are mostly 1 to 3 feet higher than the original surface. Slopes are mainly less than 5 percent, but some dunes have slopes as great as 20 percent.

The Nobscot soil covers about 35 percent of this unit. It is on the smoother and less duned areas. The surface layer of a representative profile of Nobscot soil is brown fine sand about 24 inches thick. It is single grain, loose when dry and moist, and slightly acid.

The next layer is yellowish-red fine sandy loam about 30 inches thick. It is weak subangular blocky, soft, slightly acid, and contains streaks and balls of sandy clay loam.

The underlying material, extending to a depth of about 65 inches, is light reddish-brown, unconsolidated fine sand.

The Tivoli soil is duned and covers about 18 percent of this unit. The surface layer of a representative area of Tivoli soil is brown fine sand about 4 inches thick. It is single grain, loose when dry and moist, and neutral.

The underlying material, extending to a depth of about 60 inches, is light reddish-brown, neutral fine sand.

Brownfield and Springer soils make up about 10 percent of this mapping unit. Soils similar to Nobscot but with surface layers less than 20 inches thick make up about 30 percent of the unit. About 7 percent consists of scoured areas of exposed reddish-yellow sandy loam lower layers.

About 60 percent of this mapping unit is now used as range. The soils of this unit are slightly subject to water erosion and highly subject to soil blowing. Capability unit VIe-7; Deep Sand range site.

Obaro Series

The Obaro series consists of gently sloping calcareous soils on uplands. These soils are moderately deep, reddish in color, and friable. They have convex slopes. The underlying material is Permian sandstone and packsand.

In a representative profile, the surface layer is reddish-brown loam about 8 inches thick. The next layer is very friable loam about 22 inches thick. It is reddish brown in the upper part and light red in the lower part. Below this, and extending to a depth of 60 inches, is red, weakly cemented, calcareous sandstone.

Representative profile of Obaro loam, 3 to 5 percent slopes, 50 feet east of a ranch road, from a point 2.05 miles north on the ranch road from its intersection with U.S. Highway 380, which is 2.7 miles east of Clairemont, Tex.

A1--0 to 8 inches, reddish-brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) when moist; weak subangular blocky structure; slightly hard, very friable; many roots; few calcium carbonate-coated sandstone fragments on surface and in horizon; calcareous; moderately alkaline; clear, smooth boundary.

B2--8 to 18 inches, reddish-brown (2.5YR 5/4) loam, dark reddish brown (2.5YR 3/4) when moist; compound weak prismatic structure parting to moderate, medium, subangular blocky; slightly hard, very friable; numerous roots; many fine pores; common worm casts; films and threads of calcium carbonate; few, hard, calcium carbonate-coated, sandstone fragments 5 to 20 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

B3ca--18 to 30 inches, light-red (2.5YR 6/6) loam, red (2.5YR 4/6) when moist; compound weak prismatic structure parting to moderate, medium, subangular blocky; hard, very friable; few roots; few, calcium carbonate-coated, hard, sandstone fragments 5 to 20 millimeters in diameter; estimated 10 percent calcium carbonate as coatings and soft powdery films; calcareous; moderately alkaline; clear, smooth boundary.

C--30 to 60 inches, red (2.5YR 5/6), weakly cemented, calcareous sandstone, dark red (2.5YR 3/6) when moist.

The A horizon ranges from reddish brown to reddish yellow in color and from 5 to 12 inches in thickness.

The B2 horizon ranges from reddish brown to reddish yellow in color and from 10 to 28 inches in thickness. Structure is weak to moderate prismatic and subangular blocky.

The B3ca horizon is light red to reddish yellow. Calcium carbonate content of this horizon ranges from 2 to 25 percent.

The C horizon is 20 to 48 inches below the surface and is red to reddish yellow.

Obaro loam, 1 to 3 percent slopes (ObB).--This gently sloping soil is on knolls and ridges at higher elevations than Paducah and Olton soils. Soil areas are irregular and range from 10 to several hundred acres in size. Slopes are dominantly about 1.5 percent.

The surface layer is reddish-brown loam about 7 inches thick that has weak subangular blocky structure. It is slightly hard and very friable, calcareous, and moderately alkaline.

The next layer is light-red sandy clay loam about 29 inches thick that has compound weak prismatic structure parting to moderate, medium, subangular blocky. It is slightly hard and friable, has films and threads of calcium carbonate throughout, and is about 15 percent calcium carbonate in the lower part.

The underlying material, extending to a depth of about 60 inches, is red, weakly cemented, calcareous sandstone (pl. II, center).

Mapped with this soil are areas of Weymouth and Quinlan soils that make up about 15 percent of the acreage, and areas of another soil that has a surface layer of fine sandy loam make up 10 percent. Small areas of Cottonwood, Olton, and Paducah soils also are included.

About 80 percent of this Obaro loam is in range. Where cultivated, this soil is slightly subject to soil blowing and water erosion. Capability unit IIe-1; Mixedland range site.

Obaro loam, 3 to 5 percent slopes (ObC).--This gently sloping soil lies on ridges and knolls mainly above small intermittent drains. Soil areas are irregular and dominantly about 90 acres in size, but range from 10 to several hundred acres in size. Slopes are dominantly about 4.5 percent.

This soil has the profile described as representative for the Obaro series.

Cottonwood, Paducah, and Quinlan soils form about 10 percent of the mapped acreage of this soil. About 8 percent is a soil like Obaro but with a very fine sandy loam surface layer.

This Obaro loam is mostly in range, but some areas are cultivated. This soil is susceptible to slight soil blowing and moderate water erosion hazard. Capability unit IIIe-3; Mixedland range site.

Olton Series

The Olton series consists of deep, well-drained soils that are moderately slowly permeable. These nearly level and gently sloping soils lie on upland plains in areas generally more than 1,000 acres in size. They formed in reddish, calcareous, old alluvium.

In a representative profile, the surface layer is reddish-brown clay loam about 7 inches thick. The next layer, about 31 inches thick, is firm clay loam. It is reddish brown in the upper part and red in the lower part. The underlying material,

extending to a depth of about 60 inches, is light-red clay loam in the upper part and red silt loam in the lower part.

Representative profile of Olton clay loam, 1 to 3 percent slopes, 100 feet east of a county road, from a point that is 1.05 miles east and 0.75 mile north of the Girard School.

Ap--0 to 7 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; weak granular structure; hard, friable; mildly alkaline; abrupt, smooth boundary.

B21t--7 to 15 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, blocky structure; very hard, firm; distinct clay films; mildly alkaline; gradual, smooth boundary.

B22t--15 to 38 inches, red (2.5YR 4/5) clay loam, dark red (2.5YR 3/5) when moist; moderate, medium, blocky structure; very hard, firm; distinct clay films; calcareous below a depth of 20 inches; moderately alkaline; gradual, wavy boundary.

C1ca--38 to 55 inches, light-red (2.5YR 6/6) clay loam, red (2.5YR 4/6) when moist; weak granular structure; hard, friable; an estimated 15 percent segregated calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C2--55 to 60 inches, red (2.5YR 5/6) silt loam, dark red (2.5YR 3/6) when moist; slightly altered and weakly consolidated clay loam sediments.

The A horizon ranges from reddish brown to brown in color and from 4 to 10 inches in thickness.

The B2t horizon ranges from red to reddish brown in color and from moderate to strong, fine to medium blocky or subangular blocky in structure.

Depth to the Cca horizon is 25 to 52 inches. This horizon is 15 to 40 percent calcium carbonate equivalent. Depth to the C2 horizon is 40 to 70 inches.

Olton clay loam, 0 to 1 percent slopes (OcA).--This nearly level soil is on uplands in irregular areas 15 to 200 acres in size. Slopes are dominantly about 0.5 to 1 percent.

The surface layer is dark-brown clay loam about 8 inches thick that has weak granular structure. It is hard and friable and mildly alkaline.

The next layer is very hard and firm, reddish-brown clay loam about 28 inches thick. It has moderate, medium, blocky structure, is calcareous in the lower part, and has distinct clay films.

The underlying material, extending to a depth of about 60 inches, is red calcareous clay loam. The upper part is 20 percent soft and hard masses of calcium carbonate.

Mapped with this soil are small areas of Abilene and Miles soils that make up approximately 15 percent of the acreage. Also included are Weymouth and Vernon soils on knobs or ridges less than 5 acres in size. Areas that have a calcareous surface layer make up about 10 percent of the acreage.

About 40 percent of this Olton clay loam is cultivated. Capability unit IIce-4; Deep Hardland range site.

Olton clay loam, 1 to 3 percent slopes (OcB).--Areas of this soil are irregular and from 50 to more than 1,000 acres in size. Slopes are dominantly about 1.5 percent.

This soil has the profile described as representative for the Olton series.

Mapped with this soil are small areas of Abilene, Miles, and Paducah soils that make up about 10 percent of the acreage. Weymouth and Vernon soils on knobs and ridges make up about 5 percent, and areas that have a calcareous surface layer form about 10 percent.

About 90 percent of this Olton clay loam is in native range. This soil is moderately susceptible to water erosion. In a few cultivated areas, small gullies approximately 1 foot deep and as much as 8 feet wide are at intervals of 200 to 400 feet. Capability unit IIIe-2; Deep Hardland range site.

Paducah Series

The Paducah series consists of deep, moderately permeable, well-drained soils that formed in calcareous, fine-grained, soft material weathered from sandstone. These soils are smooth, convex, and gently sloping.

In a representative profile, the surface layer is reddish-brown loam about 9 inches thick. The next layer is firm sandy clay loam about 29 inches thick. It is reddish brown in the upper part and yellowish red in the lower part. The underlying material is about 26 inches of loam. It is light red in the upper 12 inches and contains an accumulation of calcium carbonate. The lower 14 inches is red.

Representative profile of Paducah loam, 1 to 3 percent slopes, in range 50 feet south of a county road, from a point that is 2.3 miles east on the county road from its intersection with Texas Highway 70. This intersection is 6.2 miles south on Texas Highway 70 from its intersection with U.S. Highway 380, and about 11.7 miles south and east of Claremont, Tex.

A1--0 to 9 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; weak subangular blocky structure; slightly hard, friable; mildly alkaline; gradual, smooth boundary.

B21t--9 to 18 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; many worm casts; many fine pores; discontinuous clay films; mildly alkaline; abrupt, smooth boundary.

B22t--18 to 38 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; many worm casts; many fine pores; many films and threads of calcium carbonate; patchy clay

films; calcareous; moderately alkaline; clear, wavy boundary.

C1ca--38 to 50 inches, light-red (2.5YR 6/6) loam, red (2.5YR 4/6) when moist; many hard calcium carbonate concretions, estimated 20 percent calcium carbonate; clear, wavy boundary.

C2--50 to 64 inches, red (2.5YR 5/6) loam, dark red (2.5YR 3/6) when moist; partially weathered red beds.

The A horizon ranges from brown to reddish brown in color and from 6 to 14 inches in thickness.

The B2t horizon ranges from reddish brown to reddish yellow in color and from 15 to 35 inches in thickness. Structure of this horizon is weak to moderate prismatic, or weak to moderate subangular blocky, or a compound of the two.

The Cca horizon is 36 to 48 inches below the surface. This horizon is 5 to 30 percent calcium carbonate.

Paducah loam, 1 to 3 percent slopes (PaB).--This well-drained, gently sloping soil is in irregularly shaped areas associated with small drains. These areas are dominantly 50 acres in size but range from 20 to 100 acres. Slopes are dominantly about 2 percent.

This soil has the profile described as representative for the Paducah series.

Mapped with this soil are small areas of Obaro soils that make up about 5 percent of the acreage. About 10 percent is made up of a soil that has a silt loam or very fine sandy loam surface layer. Also included are a few areas of Wichita soils.

About 85 percent of this Paducah loam is in native range. This soil is moderately susceptible to water erosion. Sheet erosion and small gullies about 12 inches deep, separated by intervals of about 200 feet, are evident in some fields. The gullies form where runoff concentrates. Capability unit IIe-1; Mixedland range site.

Polar Series

The Polar series consists of moderately deep to deep soils on uplands. These soils are on an irregular series of small hills that have rounded crests. They formed in a water-deposited combination of gravel and finer material.

In a representative profile, the surface layer is brown gravelly sandy loam about 7 inches thick (pl. II, right). The underlying material, extending to a depth of about 60 inches, is very gravelly sandy loam that is light brown in the upper part and reddish brown in the lower part.

Representative profile of Polar gravelly sandy loam, in an area of Polar and Berda soils, hilly, in a roadside cut on Polar Road, 1.8 miles northwest on Polar Road from its intersection with Farm Road 1231. This intersection is about 4.5 miles southwest on Farm Road 1231 from its intersection with U.S. Highway 380, which is 5 miles southwest of Clairemont, Tex.

A--0 to 7 inches, brown (7.5YR 5/4) gravelly sandy loam, dark brown (7.5YR 3/4) when moist; weak granular structure; slightly hard, very friable; few roots; some pebbles have calcium carbonate coatings on lower side; surface has higher concentration of pebbles than in horizon; estimated 40 percent of mass is pebbles larger than 2 millimeters; calcareous; moderately alkaline; clear, wavy boundary.

C1ca--7 to 24 inches, light-brown (7.5YR 6/3) very gravelly sandy loam, brown (7.5YR 4/3) when moist; massive; porous; hard, firm; few scattered roots; most pebbles are entirely coated with calcium carbonate; pebbles in upper part are weakly cemented with calcium carbonate; estimated 65 percent of material is larger than 2 millimeters; estimated 20 percent calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C2--24 to 60 inches, reddish-brown (5YR 5/4) very gravelly sandy loam, reddish brown (5YR 4/4) when moist; massive; soft, very friable; some pebbles have coatings of calcium carbonate; estimated 65 percent of material is larger than 2 millimeters; estimated 3 percent calcium carbonate; evident strata of cross-bedded sand and gravel; calcareous; moderately alkaline.

The A horizon ranges from reddish brown to yellowish brown in color and from 4 to 12 inches in thickness. Texture ranges from gravelly sandy loam to gravelly loam or gravelly sandy clay loam.

The C horizon ranges from reddish brown to brownish yellow in color and from gravelly sandy loam to gravelly loam or gravelly sandy clay loam in texture. Gravel content of this horizon is 35 to 80 percent. The calcium carbonate equivalent of the Cca horizon is 15 to 40 percent. Depth to red-bed material is 20 inches to several feet.

Polar gravelly loam, undulating (PgB).--This soil lies in long narrow ridges about 30 to 50 feet above the surrounding soils. Soil areas are from 5 to 100 acres in size. Slopes are convex and dominantly about 2 to 8 percent.

In a representative profile, the surface is brown gravelly loam, about 8 inches thick, that has moderate, fine, granular structure. It is hard, friable, calcareous, and moderately alkaline, and is about 15 percent large limestone fragments and quartz pebbles.

The underlying material, extending to a depth of about 60 inches, is light-brown, calcareous, unconsolidated loam. It is about 50 percent limestone fragments and quartz pebbles, and the upper part is about 15 percent calcium carbonate. A slightly cemented calcareous sandy clay loam layer that is about 10 percent quartz pebbles and hard calcium carbonate concretions lies at a depth of about 20 inches.

Mapped with this soil are a few small areas of Berda and Vernon soils. Small spots of raw, exposed caliche also are included. Some slopes are as great as 40 percent, and water erosion has removed some

of the surface soil from some of the steeper areas.

All of this Polar gravelly loam is in range. Capability unit VIIs-1; Gravelly range site.

Polar and Berda soils, hilly (PhD).--The gently rolling to hilly soils of this mapping unit are on an irregular series of small hills that have rounded crests. These hills are separated by small intermittent drains. Slopes are dominantly 8 to 20 percent, but some are as great as 30 percent. The areas of this unit are irregularly shaped and from 10 to 400 acres in size.

Polar soils make up about 54 percent of this mapping unit, Berda soils about 22 percent, and areas of less extensive soils 24 percent.

Polar soils occupy the crests and sides of hills. These soils have the profile described as representative for the Polar series.

Berda soils formed in the small, intermittent drains separating the hills. In a representative profile, the surface layer of the Berda soil is brown fine sandy loam, about 9 inches thick, that has weak subangular blocky structure. It is slightly hard, very friable, calcareous, moderately alkaline, and contains a few quartz pebbles.

The next layer is reddish-brown sandy clay loam, about 28 inches thick, that has weak prismatic structure. It is slightly hard, is friable, and contains a few quartz pebbles and films and threads of calcium carbonate.

The underlying material, extending to a depth of about 60 inches, is light reddish-brown, unconsolidated fine sandy loam that is about 15 percent quartz pebbles. This material has some accumulation of calcium carbonate.

Mapped in this unit are less extensive areas of Cobb, Miles, Quinlan, and Spade soils. Also included are areas where gravelly sandy loam is 6 to 20 inches deep over sandy Permian material.

All of this unit is in range. The hilly nature of these areas makes them unsuitable for cultivation. Geologic erosion is active in areas where the sandy Permian deposits are exposed. Capability unit VIIs-1; Polar soils in Gravelly range site, and Berda soils in Sandy Loam range site.

Quinlan Series

The Quinlan series consists of shallow, well-drained to somewhat excessively drained soils on uplands. These soils have moderately rapid permeability.

In a representative profile, the surface layer is yellowish-red very fine sandy loam about 6 inches thick. The next layer is very friable, reddish-yellow very fine sandy loam about 10 inches thick. Below this, and extending to a depth of about 36 inches, is weakly cemented, calcareous sandstone.

Representative profile of Quinlan very fine sandy loam, in an area of Quinlan soils, sloping, 1.2 miles north on a ranch road from the headquarters of the George Branch Ranch, which is about 0.8 mile north on ranch road from the county road. The intersection of the county road and ranch road is 2.1 miles northwest of Jayton, Tex. by way of U.S. Highway 70, then 6 miles east on county road.

A1--0 to 6 inches, yellowish-red (5YR 5/6) very fine sandy loam; yellowish red (5YR 4/6) when moist; weak subangular blocky structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

B2--6 to 16 inches, reddish-yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 4/6) when moist; compound weak prismatic structure and weak subangular blocky; soft, very friable; many worm casts; many fine pores; common films and threads of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

C--16 to 36 inches, reddish-yellow (5YR 6/6) weakly cemented sandstone that contains gray and red flakes, yellowish red (5YR 4/8) when moist; calcareous; moderately alkaline.

The A horizon ranges from reddish brown to reddish yellow in color and from 4 to 10 inches in thickness. The B horizon ranges from reddish brown to reddish yellow in color and from 3 to 12 inches in thickness. Structure is weak to moderate subangular blocky, prismatic, or a compound of the two.

The C horizon is red to reddish yellow and 10 to 20 inches below the surface. This horizon is soft to strongly cemented sandstone.

Quinlan soils, sloping (QuC).--These gently sloping to steep soils are in irregular areas 50 to more than 1,000 acres in size. Slopes are dominantly 3 to 25 percent.

These soils have the profile described as representative for the Quinlan series.

Mapped with these soils are areas of Paducah, Woodward, and Yahola soils that make up about 10 percent of the acreage. Another inclusion is a soil that has a red, very fine sandy loam surface layer less than 10 inches thick over soft to hard gypsum. This soil makes up about 30 percent of the acreage. Small areas of rough breaks also are included. These areas are suitable for grazing and wildlife.

All of these Quinlan soils are in range. Geologic erosion is locally active in the steep and rough broken areas. Most grazing is produced on the smoother areas or areas not actively eroding. Capability unit VIe-4; Mixedland range site.

Randall Series

The Randall series consists of deep, clayey, very slowly permeable soils. In most places these soils are on the bottoms of enclosed depressions or playas. They receive runoff water from surrounding soil and are submerged for several weeks. The soils lie from a few feet to nearly 30 feet below the surrounding plains.

In a representative profile, the surface layer is dark-gray clay in the upper 8 inches and very firm, gray clay in the lower 26 inches. The underlying material, extending to a depth of about 64 inches, is massive clay. It is gray in the upper part and brown in the lower part.

Representative profile of Randall clay, 0.3 mile south of a county road from a point on the county road 1.2 miles west of the intersection of Farm Road 948 and Farm Road 2320, which is about 7 miles north of Clairemont, Tex.

A11--0 to 8 inches, dark-gray (10YR 4/1) clay; very dark gray (10YR 3/1) when moist; moderate, fine, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; neutral; diffuse, wavy boundary.

A12--8 to 34 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) when moist; moderate, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; a few slickensides evident; neutral; diffuse, wavy boundary.

C1--34 to 48 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; massive; very hard, very firm, very sticky and very plastic; few magnesium or iron concretions; mildly alkaline; diffuse, wavy boundary.

C2--48 to 64 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) when moist; massive; very hard, very firm, very sticky and very plastic; mottled with 30 percent gray; few magnesium or iron concretions; mildly alkaline.

The A horizon ranges from very dark gray to gray in color, and from 27 to 60 inches in thickness. It is weak to moderate subangular blocky to blocky in structure and neutral to moderately alkaline in reaction. The C horizon ranges from dark gray to brown in color.

Randall clay (Ra).--This nearly level soil lies in rounded or irregularly oval shaped depressed areas. Soil areas are dominantly 25 acres in size but range from 5 to 80 acres. Shrinking and swelling has formed small depressions and humps on the surface. Slopes of most areas are less than 0.5 percent.

Mapped with this soil are a few areas that are reddish brown in color. A few areas have a few inches of fine sandy loam or sandy clay loam at the surface. This inclusion makes up about 15 percent of the acreage.

Areas left bare by cultivation or by the drowning of protective vegetation during extended wet periods are subject to slight soil blowing.

Only about 20 percent of this Randall clay is cultivated; the rest is in range. Floods caused by runoff from adjacent soils occur in most years. Capability unit VIw-1; included with surrounding range site.

Rough Broken Land

Rough broken land (Ro) is a miscellaneous land type consisting of steep, rough and broken areas, steep banks along the rivers, and local areas where geologic erosion has cut deep gullies into Permian packsand and sandstone along intermittent drains.

Most of the areas of this mapping unit are characterized by slopes of about 40 percent. These areas commonly have ledges of hard alabaster gyprock or sandstone along the faces of the slopes. Most areas are long and narrow and contain V-shaped gullies from 20 to 150 feet deep (pl. IV, top).

Included in this mapping unit are small areas of Latom, Quinlan, Vernon, and Woodward soils.

This mapping unit supports only sparse vegetation. All of this unit is in range. Some areas have limited accessibility for grazing by cattle. The areas of this unit are highly susceptible to water erosion and are very erodible in most places. They are suitable for only limited grazing and for wildlife. Capability unit VIIs-2; Rough Breaks range site.

Spade Series

The Spade series consists of moderately deep, moderately permeable soils on uplands.

In a representative profile, the surface layer is brown fine sandy loam about 6 inches thick. The next layer is very friable, brown fine sandy loam about 16 inches thick. The underlying material is very pale brown fine sandy loam about 12 inches thick over calcareous sandstone.

Representative profile of Spade fine sandy loam, 3 to 5 percent slopes, in range 0.75 mile east of Farm Road 1142 from a point that is 1.7 miles south of the old Polar School.

A1--0 to 6 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak granular structure; slightly hard, very friable; few sandstone fragments; calcareous; moderately alkaline; clear, smooth boundary.

B--6 to 22 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak subangular blocky structure; slightly hard, very friable; common calcium carbonate-coated sandstone fragments; many worm casts; many pores; calcareous; moderately alkaline; clear, wavy boundary.

Cca--22 to 34 inches, very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) when moist; structureless; many sandstone fragments and some calcium carbonate accumulations; abrupt, wavy boundary.

R--34 to 38 inches, interbedded, weakly and strongly cemented, calcareous sandstone.

The A horizon ranges from reddish brown to light yellowish brown in color and from 4 to 12 inches in thickness.

The B horizon ranges from reddish brown to light brown in color, from 8 to 28 inches in thickness, and from moderate, coarse, prismatic to weak subangular blocky in structure. Depth to soft or hard sandstone is 20 to 48 inches.

Spade fine sandy loam, 1 to 3 percent slopes (SdB).--This soil is in areas 5 to more than 100 acres in size on long narrow ridges and slopes between outwash soils and soils formed from red beds. Slopes are dominantly about 2 percent.

In a representative profile, the surface layer is brown fine sandy loam, about 8 inches thick, that has weak granular structure. It is slightly hard, very friable, calcareous, and moderately alkaline. This layer contains a few sandstone fragments and quartz pebbles.

Underlying this is light-brown fine sandy loam, about 16 inches thick, that has moderate, medium, granular structure. This layer is slightly hard, very friable, calcareous, and moderately alkaline. It contains common sandstone fragments and quartz pebbles.

The underlying material, extending to a depth of about 40 inches, is white and light gray sandstone that is weakly cemented and slightly altered. This layer contains visible carbonates in the upper part and hard to soft unaltered sandstone at a depth of 36 inches.

Included with this soil in mapping are areas of Vernon clay loam less than 5 acres in size and a few sandstone and conglomerate outcrops. About 5 percent of the acreage is Latom soils. Some areas that have sandy clay loam textures in the B horizon also are included. Small areas that either have no sandstone underlying the soil or the sandstone is too deep to fit the description of Spade fine sandy loam make up about 5 percent of the acreage.

Only about 15 percent of this Spade fine sandy loam is cultivated; the rest is in range. Capability unit IIIe-8; Sandy Loam range site.

Spade fine sandy loam, 3 to 5 percent slopes (SdC).--This soil is on ridges, knobs, and slopes between areas of outwash soils and soils formed in red beds. Soil areas are from 5 to 80 acres in size.

This soil has the profile described as representative for the Spade series (pl. III, left).

Mapped with this soil are small sandstone and conglomerate outcrops and small areas of Latom fine sandy loam. The areas of Latom soil make up about 10 percent of the acreage. Areas of Vernon clay loam less than 5 acres in size and some areas of a soil that has a sandy clay loam B horizon also are included.

Most of this Spade fine sandy loam is used for range. Water erosion has formed gullies in some areas. Capability unit IVe-5; Sandy Loam range site.

Springer Series

The Springer series consists of deep, friable soils on uplands. These soils are gently sloping to sloping.

In a representative profile, the surface layer is light-brown loamy fine sand about 16 inches thick. The next layer is very friable sandy loam about 26 inches thick. It is reddish brown in the upper part and yellowish red in the lower part. Below this layer is reddish-yellow loamy sand about 14 inches thick. The next layer, extending to a depth of 84 inches, is sandy loam. It is yellowish red in the upper part and reddish yellow in the lower part.

Representative profile of Springer loamy fine sand, 0 to 3 percent slopes, in pasture 300 feet southeast of a roadside park, from a point on U.S. Highway 380 that is 4.6 miles southwest of the junction of U.S. Highway 380 and Texas Highway 70, which is 1 mile south of Jayton, Tex.

A1--0 to 16 inches, light-brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; single grain; loose; neutral; gradual, smooth boundary.

B2t--16 to 30 inches, reddish-brown (5YR 5/4) sandy loam, reddish brown (5YR 4/4) when moist; compound weak prismatic and weak subangular blocky structure; slightly hard, very friable; few pockets of sandy clay loam; few fine pebbles; mildly alkaline; gradual, smooth boundary.

B3--30 to 42 inches, yellowish-red (5YR 5/6) sandy loam, yellowish red (5YR 4/6) when moist; compound weak prismatic and weak subangular blocky structure; slightly hard, very friable; few clean sand grains; pockets of sandy clay loam; mildly alkaline; gradual, smooth boundary.

A'2--42 to 56 inches, reddish-yellow (5YR 6/6) loamy sand, yellowish red (5YR 5/6) when moist; structureless; few pockets of clean sand grains; mildly alkaline; clear, smooth boundary.

B'2t--56 to 72 inches, yellowish-red (5YR 5/6) sandy loam, yellowish red (5YR 4/6) when moist; weak, medium, subangular blocky structure; hard, very friable; few pockets of sandy clay loam; sand grains are bridged and coated; mildly alkaline; diffuse, wavy boundary.

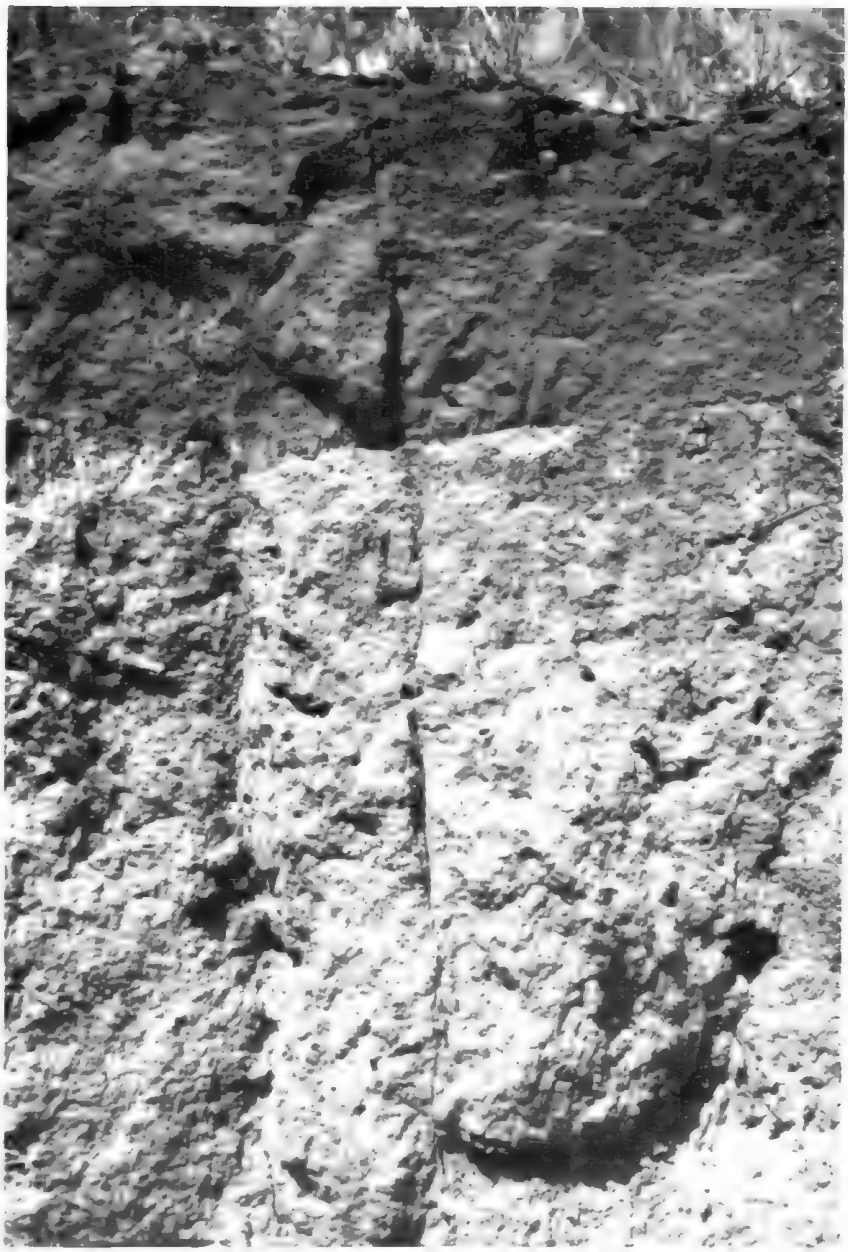
B'3--72 to 84 inches, reddish-yellow (5YR 6/6) sandy loam, yellowish red (5YR 5/6) when moist; weak, medium, subangular blocky structure; soft, very friable; few pockets of clean sand grains; few bands and pockets of sandy clay loam material; mildly alkaline.

The A horizon ranges from reddish brown to reddish yellow in color and from 10 to 20 inches in thickness.

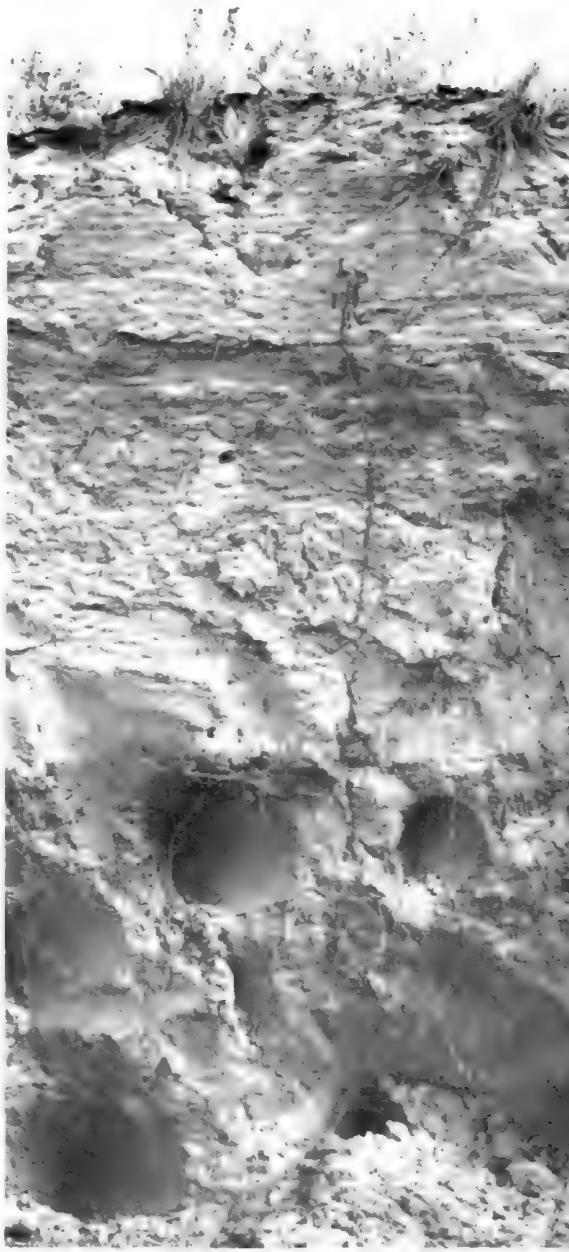
The B2t horizon ranges from reddish brown to reddish yellow in color and from 10 to 20 inches in thickness.

The B3 horizon ranges from reddish yellow to reddish brown and strong brown in color and from 12 to 36 inches in thickness.

Texture of the A'2 horizon is loamy fine sand to fine sand. Pockets of clean sand grains range from few to common. The B' horizon is reddish brown to reddish yellow.

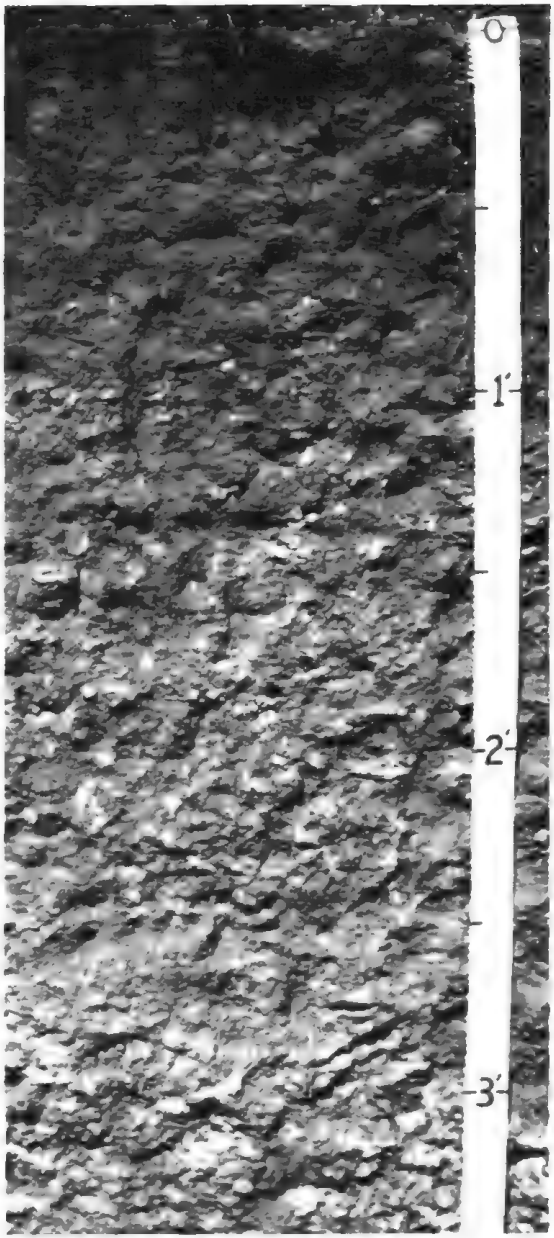


Profile of Berda fine sandy loam



Profile of Lincoln fine sand

Profile of Miles loamy fine sand



Profile of Obaro loam

Profile of Pc

Profile of Spade fine sandy loam

Profile of Vernon clay

Area of Rough broken land showing steep slopes and V-shaped gullies

Typical area of Vernon - Badland complex, sloping

Oats interseeded in grain-sorghum stubble on Miles fine sandy loam, 0 to 1 percent slopes. The oats keep the soil from blowing during dry, windy periods.

Water erosion on a field of Berda fine sandy loam, 1 to 3 percent slopes. A terrace system would reduce loss of water and soil material.

Former cropland on Woodward and Quinlan loams that has been reseeded to side-oats grama. A solid stand such as this provides excellent grazing.

Sandyland range site. The soil is Miles loamy fine sand.

Springer loamy fine sand, 0 to 3 percent slopes (SgB).--This nearly level to gently undulating soil is on upland plains. Soil areas are broad and dominantly 100 acres in size, but range from 20 to several hundred acres in size. Slopes are about 0.5 to 1.5 percent.

This soil has the profile described as representative for the Springer series.

Mapped with this soil are areas of Brownfield, Miles, and Nobscot soils that make up about 15 percent of the acreage.

Most areas of this Springer loamy fine sand are in range, but a few small areas are cultivated. These soils are highly subject to soil blowing. Capability unit IVe-11; Sandyland range site.

Springer loamy fine sand, 3 to 8 percent slopes (SgD).--This soil is on hummocky upland plains or in sloping areas along old drains. Soil areas are irregularly shaped and range from 10 to 100 acres in size. Slopes are dominantly about 6 percent.

The surface layer is brown loamy fine sand, about 16 inches thick, that is single grain and loose when dry or moist. It is neutral and contains a few quartz pebbles.

The next layer is brown and light reddish-brown sandy loam that is more than 48 inches thick. It is mildly alkaline to a depth of 30 inches, has films and threads of calcium carbonate below 30 inches, and contains a few quartz pebbles.

The underlying material, extending to a depth of about 84 inches, is reddish, unconsolidated, sandy loam material that is calcareous.

Mapped with this soil are areas of Miles loamy fine sand that make up about 8 percent of the acreage. Nobscot fine sand makes up another 5 percent.

About 95 percent of this Springer loamy fine sand is in range. This soil is highly susceptible to soil blowing and water erosion. Capability unit VIe-6; Sandyland range site.

Tivoli Series

The Tivoli series consists of deep, loose, sandy soils of the uplands.

These soils are billowy, hummocky areas immediately above the flood plains of rivers. Soil areas are irregular and 15 to nearly 200 acres in size.

In a representative profile, the surface layer is light-brown fine sand about 7 inches thick. The underlying material, extending to a depth of about 60 inches, is reddish-yellow fine sand.

Representative profile of Tivoli fine sand, in range 0.35 mile west of a point on a county road that is 0.38 mile north of the intersection of the county road and U.S. Highway 380. This intersection is 0.6 mile northeast of the Brazos River bridge on U.S. Highway 380 and about 7 miles southwest of Jayton, Tex.

A1--0 to 7 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 4/4) when moist; structureless and single grain; loose when dry or moist; calcareous; moderately alkaline; gradual, smooth boundary.

C--7 to 60 inches, reddish-yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) when moist; structureless and single grain; loose when dry or moist; calcareous; moderately alkaline.

The A horizon ranges from brown to reddish yellow in color and from 4 to 10 inches in thickness. Color of the C horizon ranges from light reddish brown to reddish yellow. The reaction of both horizons ranges from neutral to moderately alkaline.

Tivoli fine sand (Tv).--This soil is in hummocky areas along rivers. Soil areas are irregular and about 50 acres in size. Slopes of the dunes range from 8 to 40 percent. Small undulating areas, from 5 to 200 feet wide, are between the dunes.

This soil has the profile described as representative for the Tivoli series.

All of this Tivoli fine sand is in range. It is highly susceptible to soil blowing. Capability unit VIIe-1; Deep Sand range site.

Vernon Series

The Vernon series consists of moderately deep, very slowly permeable, well-drained soils on uplands.

In a representative profile, the surface layer is reddish-brown clay loam about 6 inches thick. The next layer is very firm, reddish-brown clay about 12 inches thick. The underlying material is reddish-brown shaly clay in the upper 12 inches and red, unweathered clayey shale extending to a depth of about 42 inches.

Representative profile of Vernon clay loam, in an area of Vernon soils, sloping, in range 0.3 mile south of U.S. Highway 380, from a point that is 3.5 miles west on U.S. Highway 380 from its intersection with Farm Road 1081, which is about 11 miles west of Clairemont, Tex.

A1--0 to 6 inches, reddish-brown (5YR 5/4) clay loam, dark reddish brown (5YR 3/4) when moist; weak subangular blocky structure; hard, firm; few fine pores; calcareous; moderately alkaline; clear, smooth boundary.

B--6 to 18 inches, reddish-brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) when moist; moderate, medium, subangular blocky structure; very hard, very firm, sticky and plastic; few soft masses of calcium carbonate; few fine pores; few quartz pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

C1--18 to 26 inches, reddish-brown (2.5YR 5/4) shaly clay, reddish brown (2.5YR 4/4) when moist; structureless; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C2--26 to 42 inches, red unweathered, clayey shale that has gray mottles.

The A1 horizon ranges from reddish brown to yellowish red in color and from 5 to 9 inches in thickness. Texture of the A horizon ranges from clay loam to clay, and structure is granular to blocky.

The B horizon ranges from reddish brown to yellowish red in color and from 5 to 16 inches in thickness.

The C horizon is 4 to 20 inches thick. Calcium carbonate accumulation in this horizon ranges from a few films and threads to common concretions and masses.

The clayey shale layer is at a depth of 20 to 30 inches. This layer ranges from massive clay to clayey and silty shale.

Vernon soils, sloping (VeC).--These soils are on convex ridges and footslopes below outwash soils. Soil areas are irregular and from 5 to several hundred acres in size. Slopes are dominantly about 3 percent but range from about 1 to 5 percent.

These soils have the profile described as representative for the Vernon series (pl. III, right).

Mapped with these soils are small areas of Spade, Weymouth, and Wichita soils that make up about 8 percent of the acreage. Soils that are clay loam in texture and less than 10 inches thick over unweathered red-bed clays or shales make up about 10 percent. A few areas of exposed red-bed sandstone or conglomerate outcrop also are included.

Most of these Vernon soils are in range. These soils are subject to a moderate hazard of water erosion. Water erosion has cut a few gullies 1 to 4 feet deep and 1 to 10 feet wide in some areas. Capability unit VIe-1; Shallow Redland range site.

Vernon-Badland complex, sloping (VrC).--Soils of this mapping unit are in irregularly shaped areas marked by gullies. They have a well-defined drainage pattern, and runoff water is carried quickly from these areas (pl. IV, bottom). Relief ranges from about 10 to 40 feet.

Areas of this mapping unit are from 20 to several hundred acres in size. Except for gullied areas and exposed shaly and clayey areas, the slopes are mostly smooth and in the range of 2 to 8 percent.

The Vernon soil occupies most of the smooth, convex, and vegetated part of this mapping unit and makes up 43 percent of the unit. The surface layer of the Vernon soil is reddish-brown clay loam about 7 inches thick. It has weak subangular blocky structure and is calcareous and moderately alkaline.

The next layer is calcareous and moderately alkaline, red clay about 9 inches thick. This layer is hard and very firm, has moderate medium, subangular blocky structure, and contains a few soft masses of calcium carbonate.

The underlying material is layered, red shaly clay fragmenting to clayey shale in the lower part. The upper 6 inches contains films and threads of calcium carbonate.

Badland makes up about 26 percent of this mapping unit. Badland is exposed shale and clay on ridges, knobs, and sloping areas along drains and gullies. Slopes of these areas range from about 3 to 8 percent.

Included in this mapping unit are small areas of Clairemont, Obaro, Quinlan, Weymouth, and Wichita soils. Local areas covered with soil materials washed from higher areas, and other areas that have as much as 30 percent slope also are included. These inclusions make up about 31 percent of the unit.

All of this mapping unit is in native range. This unit is best suited to range, wildife, or recreational uses. Capability unit VIIs-1; Shallow Redland range site.

Weymouth Series

The Weymouth series consists of moderately deep, moderately permeable, well-drained soils. These gently sloping soils occupy uplands. They formed in Permian and Triassic red-bed shales and clays.

In a representative profile, the surface layer is reddish-brown clay loam about 6 inches thick. The next layer, about 22 inches thick, is friable clay loam that is reddish brown in the upper part and red in the lower part. The underlying material, extending to a depth of about 48 inches, is red clay loam.

Representative profile of Weymouth clay loam, 1 to 3 percent slopes, near a point 0.3 mile southwest on a ranch road from its intersection with Farm Road 1081. This intersection is 2.2 miles south on Farm Road 1081 from the Kent and Dickens County line.

A1--0 to 6 inches, reddish-brown (5YR 5/4) clay loam, dark reddish brown (5YR 3/4) when moist; weak granular structure; hard, friable; an estimated 25 percent, by volume, worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B21--6 to 17 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, fine and medium, subangular blocky structure; hard, friable; an estimated 35 percent, by volume, worm casts; 10 percent calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B22ca--17 to 28 inches, red (2.5YR 5/6) clay loam, red (2.5YR 4/6) when moist; weak subangular blocky structure; hard, friable; an estimated 20 percent worm casts; 15 percent calcium carbonate masses; calcareous; moderately alkaline; gradual, wavy boundary.

C--28 to 48 inches, red (2.5YR 5/6) clay loam, slightly darker red (2.5YR 4/6) when moist; structureless; hard, friable; slightly altered and weakly consolidated, red-bed sediments.

The A horizon ranges from brown to reddish brown in color and from 4 to 8 inches in thickness. Structure of the A horizon ranges from weak to moderate, fine to medium, granular and subangular blocky.

The B2 horizon ranges from reddish brown to light reddish brown in color and from 16 to 32 inches in thickness. Structure is weak to moderate, fine to medium, granular or subangular blocky and

medium to coarse prismatic. Depth to the B22ca horizon ranges from 12 to 24 inches. The C horizon is 20 to 40 inches below the surface.

Weymouth clay loam, 1 to 3 percent slopes (WeB).--This gently sloping soil is on ridges and knobs in irregular areas from 5 to 200 acres in size. Slopes are dominantly about 2 percent.

This soil has the profile described as representative for the Weymouth series.

Included with this soil in mapping is a soil that has a loam surface layer. It makes up about 10 percent of the acreage. Obaro, Olton, and Vernon soils make up another 10 percent, and gravelly knobs less than 3 acres in size make up 2 percent.

About 14 percent of this Weymouth clay loam is cultivated, and the rest is in range.

This Weymouth clay loam is moderately susceptible to water erosion. In areas where this soil is cultivated and runoff water accumulates, small gullies have formed at 300 to 500 foot intervals. These gullies are mainly less than 1 foot deep and 8 to 15 feet wide. Capability unit IIIe-7; Shallow Redland range site.

Weymouth clay loam, 3 to 5 percent slopes (WeC).--This soil is on ridges and side slopes of small drains in irregular areas mainly less than 100 acres in size. Slopes are dominantly about 4 percent.

The surface layer is reddish-brown clay loam about 6 inches thick. It is hard and friable, calcareous, and moderately alkaline. It has weak granular structure.

The next layer is reddish-brown and red clay loam about 18 inches thick. This layer has weak to moderate, fine and medium, subangular blocky structure and is about 15 percent calcium carbonate in the lower part.

The underlying material is slightly altered, weakly consolidated, red clay loam.

Mapped with this soil are small areas of Vernon and Obaro soils and a few small gravelly knobs. Olton soils make up about 8 percent of the acreage. Another inclusion that makes up about 5 percent is a soil similar to Weymouth, but it has a loam surface layer.

About 5 percent of this Weymouth clay loam is cultivated, and the rest is in range. Water erosion is a hazard in cultivated areas. In some places where water concentrates, small gullies 6 to 18 inches deep and as much as 20 feet wide occur at 200 to 400 foot intervals. Capability unit IVe-2; Shallow Redland range site.

Wichita Series

The Wichita series consists of deep, moderately slowly permeable, well-drained soils of the uplands.

In a representative profile, the surface layer is reddish-brown silt loam about 7 inches thick. The next layer is firm, reddish-brown silty clay loam in the upper 39 inches and firm, red silty clay loam in the lower 18 inches. The underlying material, extending to a depth of about 70 inches, is red silt loam.

Representative profile of Wichita silt loam, 1 to 3 percent slopes, 0.65 mile south of the ranch house on the Weldon Johnson ranch, which is about 16 miles west of Clairemont, Tex.

A1--0 to 7 inches, reddish-brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/4) when moist; weak subangular blocky structure; hard, friable; mildly alkaline; clear, smooth boundary.

B21t--7 to 16 inches, reddish-brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; very hard, firm; few patchy clay films; few worm casts; few fine pores; mildly alkaline; clear, smooth boundary.

B22t--16 to 46 inches, reddish-brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; very hard, firm; few patchy clay films; few worm casts; few pores; few films of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3--46 to 64 inches, red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) when moist; weak subangular blocky structure; very hard, firm; common pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C--64 to 70 inches, red (2.5YR 5/6) silt loam, red (2.5YR 4/6) when moist; structureless; few films and threads of calcium carbonate; few fragments of unweathered shale.

The A horizon ranges from reddish brown to brown in color and from 5 to 10 inches in thickness.

The B horizon ranges from reddish brown to reddish yellow in color and from 50 to 60 inches in thickness. Structure of the B horizon is weak to moderate, coarse, prismatic or weak to moderate, medium, subangular blocky, or both.

The C horizon is at a depth of 60 to 70 inches. It is soft to hard, partially weathered, red-bed shale.

Wichita silt loam, 1 to 3 percent slopes (WhB).--This gently sloping soil is on uplands in large irregular areas. Slopes are dominantly about 2 to 2.5 percent.

This soil has the profile described as representative for the Wichita series.

Mapped with this soil is a soil that has a surface layer that is 4 to 15 inches thick over silty and clayey shale. It makes up about 10 percent of the acreage. About 20 percent is a soil that is calcareous to the surface. Areas of exposed shale, which make up about 5 percent of the acreage, and small areas of Olton soils also are included.

All of this Wichita silt loam is in range. Capability unit IIIe-2; Deep Hardland range site.

Wichita silt loam, 3 to 5 percent slopes (WhC).--This gently sloping soil is on uplands in irregular areas 20 to 200 acres in size. Slopes are dominantly about 3.5 percent.

The surface layer of a representative profile is reddish-brown silt loam about 5 inches thick. It has weak subangular blocky structure and is hard, friable, and mildly alkaline.

The next layer is reddish-brown and light-red silty clay loam about 57 inches thick. It has moderate, medium, subangular blocky structure and is noncalcareous in the upper part and calcareous in the lower part.

The underlying material, extending to a depth of about 70 inches, is light-red, platy, clayey shale that has some calcium carbonate between plates.

Included with this soil in mapping is a soil that has a 4- to 12-inch surface layer over red-bed shale. This thin soil makes up about 15 percent of the acreage, and areas of raw exposed shale make up about 8 percent. About 15 percent of this soil is calcareous to the surface.

All of this Wichita silt loam is in range. Capability unit IVe-2; Deep Hardland range site.

Woodward Series

The Woodward series consists of moderately deep, moderately permeable soils on uplands. These gently sloping to sloping soils occupy convex areas.

In a representative profile, the surface layer is yellowish-red very fine sandy loam about 6 inches thick. The next layer is very friable, reddish-yellow very fine sandy loam about 22 inches thick. The underlying material, extending to a depth of about 60 inches, is yellowish-red very fine sandy loam.

Representative profile of Woodward very fine sandy loam, in an area of Woodward and Quinlan loams, sloping, 0.4 mile north on a ranch road from the headquarters of the George Branch ranch, which is about 0.8 mile north on ranch road from county road. The intersection of the county road and ranch road is Highway 70, then 6.0 miles east on county road.

A1--0 to 6 inches, yellowish-red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) when moist; weak subangular blocky structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

B--6 to 28 inches, reddish-yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 4/6) when moist; compound weak prismatic and weak subangular blocky structure; soft, very friable; many worm casts; many fine pores; common films and threads of calcium carbonate; few sandstone flakes coated with calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

C--28 to 38 inches, yellowish-red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/8) when moist; structureless; weathered red beds containing gray flakes and streaks of red; few films and threads of calcium carbonate; gradual, wavy boundary.

R--38 to 60 inches, yellowish-red (5YR 5/6) unweathered red beds containing gray flakes and streaks of red, yellowish red (5YR 4/8) when moist; crushes to very fine sandy loam.

The A horizon ranges from reddish brown to reddish yellow in color and from 4 to 10 inches in thickness.

The B horizon ranges from reddish brown to reddish yellow in color and from 10 to 30 inches in thickness. Structure is weak to moderate prismatic, or subangular blocky, or a structure that is a compound of the two.

The C horizon is light-red to yellowish-red, soft packsand to semi-hard sandstone that shows some alteration and contains calcium carbonate accumulations. It is at a depth of 20 to 35 inches.

The R layer is light-red to yellowish-red soft packsand to semi-hard sandstone. It is 24 to 48 inches below the surface.

Woodward and Quinlan loams, sloping (WoC).--This mapping unit is made up of Woodward and Quinlan loams in non-uniform patterns and proportions. An area shown on the map may be made up of only one or both of these soils. Soil areas range from 30 to more than 1,000 acres in size. Slopes are from about 2 to 8 percent, and the dominant slope is around 7 percent.

Woodward soils make up about 55 percent of this mapping unit, Quinlan soils 34 percent, and inclusions of other soils 11 percent.

The Woodward soil in this mapping unit is on the side slopes of ridges and knolls. This soil has the profile described as representative for the Woodward series.

The Quinlan soils are mainly on the crests of the ridges and knobs. The surface layer of the Quinlan soil is yellowish-red very fine sandy loam about 5 inches thick. It is soft, very friable, calcareous, and moderately alkaline, and it has weak subangular blocky structure.

The next layer is reddish-yellow very fine sandy loam about 9 inches thick. This layer has weak subangular blocky structure and contains films and threads of calcium carbonate.

The underlying material, extending to a depth of about 60 inches, is yellowish-red very fine sandy loam in unweathered red beds that contain gray flakes.

Included in this mapping unit are small areas of a soil having a red, very fine sandy loam surface layer less than 10 inches thick over soft to hard gypsum. Some areas of Obaro, Paducah, and Vernon soils and a few areas of rough breaks and alluvial deposits also are included. Another inclusion is some areas that have slopes up to 15 percent. These inclusions make up about 11 percent of this unit.

Most of this mapping unit is used as range. The soils in this unit are best suited to grazing and wildlife. Both Woodward and Quinlan soils are slightly susceptible to soil blowing and highly susceptible to water erosion. Capability unit VIe-4; Mixedland range site.

Yahola Series

The Yahola series consists of deep, moderately rapidly permeable soils on bottom lands. Most areas of these soils are subject to overflow during periods of high rainfall. These periods of overflow are of short duration and cause little damage to vegetation.

In a representative profile, the surface layer is reddish-brown very fine sandy loam about 15 inches thick. The underlying material, extending to a depth of about 60 inches, is light reddish-brown fine sandy loam.

Representative profile of Yahola very fine sandy loam, in a cultivated field, 0.6 mile northeast on ranch road from Polar road, from a point 0.5 mile north on Polar road from its intersection with Farm Road 1231, which is about 4.5 miles south of the intersection of Farm Road 1231 and U.S. Highway 380. This intersection is about 5 miles southwest of Clairemont, Tex.

A1--0 to 15 inches, reddish-brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) when moist; weak granular structure; slightly hard, very friable; calcareous; moderately alkaline; diffuse, smooth boundary.

C--15 to 60 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) when moist; structureless; contains strata of silt loam, very fine sandy loam, and fine sand; bedding planes are evident; calcareous; moderately alkaline.

The A horizon ranges from light brown to reddish brown or red in color and from 6 to 20 inches in thickness. The C horizon has the same color range as the A horizon.

Yahola very fine sandy loam (Ya).--This nearly level soil is in irregular areas 15 to 300 acres in size. It occupies benches or flood plains of rivers and creeks throughout the county. Slopes are from 0.2 to 1 percent, and the dominant slope is about 0.5 percent.

Mapped with this soil are small areas of Berda, Clairemont, Frio, and Lincoln soils that make up about 15 percent of the acreage. Areas mainly less than 5 acres in size that are moderately affected by salinity account for 2 to 5 percent.

This Yahola very fine sandy loam is mostly in range, but about 15 percent is cultivated. This soil is subject to a slight soil blowing hazard. Capability unit IIce-3; Loamy Bottomland range site.

MANAGEMENT OF THE SOILS FOR CROPS AND PASTURE[2/]

The system of land capability classification used by the Soil Conservation Service is briefly described in this section, and management for dryland capability units is suggested. Also provided are yield predictions for major crops at a high level of management.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not consider possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (No class I soils in Kent County.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland or wildlife.

2/ By ALLEN H. KING, conservation agronomist, and WAYNE E. RICHARDSON, soil scientist, Soil Conservation Service.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (No Class VIII soils in Kent County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, e, w, s, or c to the class numeral, for example, IIe. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils, the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by w, s, and c, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-4 or IIIe-7. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Kent County are described and suggestions for the use and management of the soils are given. All of the units in the system are not represented by the soils of Kent County; therefore, the numbers are not consecutive.

The capability unit designation for all the soils in the county can be found in the "Guide to Mapping Units." The suitability of each soil for crops and suggestions for its management are given under the heading "Descriptions of the Soils." The capability unit is identified at the end of each soil series description.

Capability Unit IIce-1

This unit consists of deep, moderately to moderately slowly permeable, nearly level soils on bottom lands. They have a high available water capacity. Susceptibility to soil blowing and water erosion is slight.

These soils are easily tilled. Small grain, forage crops, and some cotton are grown. The response to cultural practices is very good. Crop rotation, protection of the soil by use of crop residue and growing crops, and timely but limited tillage are needed practices.

Capability Unit IIce-3

Yahola very fine sandy loam is the only soil in this unit. It is a deep, well-drained, nearly level soil of the bottom lands. Permeability is moderately rapid, and the available water capacity is high. Soil blowing is a slight hazard.

Cotton, small grain, and some sorghum are grown. Crop rotation, protection of the soil by retaining crop residues on the surface, and timely but limited tillage are good management practices.

Capability Unit IIce-4

This unit consists of deep, moderately slowly permeable, nearly level soils on uplands. They have a high available water capacity. The hazard of soil blowing is slight.

Cotton, small grain, and sorghum are the major crops grown. Such good management practices as crop rotation, adequate return of crop residue to the soil for improvement and protection, and timely but limited tillage are necesary for good crop response.

Capability Unit IIe-1

This unit consists of deep to moderately deep, gently sloping soils of the uplands. These soils are moderately to moderately rapidly permeable. They have a moderate to high available water capacity and are subject to a slight to moderate hazard of erosion.

Soils in this unit are easily tilled and respond to good management practices. Cotton and small grain are the major crops grown.

Erosion is controlled by retaining adequate crop residue on the soil surface, by stripcropping, by timely but limited tillage, and by use of contour farming and a system of terraces. Diversion terraces and grassed waterways are needed where excess runoff is a problem.

Capability Unit IIIe-2

The soils in this unit are deep, well-drained, gently sloping soils on uplands. They are moderately

slowly permeable and have a high available water capacity. They are subject to a slight hazard of soil blowing.

Small grain, cotton, and sorghum are grown. Crop rotation, retention of crop residue on the surface to control erosion, and timely but limited tillage are useful management practices. Contour farming, terraces, diversions, and grassed waterways also are important conservation measures for soils in this unit.

Capability Unit IIIe-3

Obaro loam, 3 to 5 percent slopes, is the only soil in this unit. This soil is moderately deep, moderately permeable, and gently sloping. It has a moderate available water capacity. This soil is slightly subject to soil blowing and moderately subject to water erosion.

Small grain and sorghums are grown on this easily tilled soil. Good management practices are crop rotation, crop residue kept on the surface for erosion control and soil improvement, and limited but timely tillage. Contour farming and terraces are necessary for control of water erosion. Grassed waterways and diverison terraces are needed in places for safe disposal of runoff.

Capability Unit IIIe-4

The soils in this unit are deep to moderately deep, moderately permeable, and nearly level to gently sloping. These soils are well drained and slightly to moderately subject to erosion. Their available water capacity is low to high.

These easily tilled soils are used to grow cotton and sorghum in rotation with small grain. A regular pattern of cotton and sorghum planted in alternate strips helps reduce erosion. Crop residue maintained on the soil surface helps prevent erosion during periods of drought and strong winds (pl. V, top).

Steeper slopes require contour farming and terracing to help control water erosion. Diversions and grassed waterways are needed where excess runoff is a problem.

Capability Unit IIIe-5

The only soil in this unit is Berda fine sandy loam, 1 to 3 percent slopes. It is deep, moderately permeable, and gently sloping. This well-drained soil has a high available water capacity. It is moderately susceptible to soil blowing and slightly susceptible to water erosion.

Small grain and sorghum are the crops best suited to this soil. They protect the soil from erosion and leave adequate residue for soil improvement. Contour farming and terraces are needed where row crops are grown (pl. V, bottom). Diversions and grassed waterways also are needed where excess runoff is a problem.

Capability Unit IIIe-7

This unit consists only of Weymouth clay loam, 1 to 3 percent slopes. It is a moderately deep, moderately permeable, and gently sloping soil. The available water capacity is high. Soil blowing is a slight hazard, and water erosion is a moderate hazard.

Small grains, sorghum, and cotton are grown on this easily tilled Weymouth clay loam. Good management calls for crop rotation and keeping crop residue on the surface to help control erosion.

Terraces and contour farming are essential for row crops. Excess water may be safely removed from the land by diversion terraces and grassed waterways.

Capability Unit IIIe-8

The only soil in this unit is Spade fine sandy loam, 1 to 3 percent slopes. It is moderately deep, gently sloping, and moderately permeable. The available water capacity is high. Soil blowing is a moderate hazard, and water erosion a slight hazard.

This soil is best suited to forage sorghum or small grain.

Crop residue left on the surface helps control soil blowing and water erosion. Minimum tillage, terraces, and contour farming also reduce erosion. Diversion terraces and grassed waterways are needed to safely dispose of excess water from adjacent lands.

Capability Unit IIIs-2

Mangum clay is the only soil in this unit. It is a deep, very slowly permeable, nearly level soil on bottom lands. It is slightly susceptible to soil blowing and has a high available water capacity.

Small grain and sorghum are among the better crops for this soil.

The clayey soil restricts penetration of roots, air, and moisture. Good management involves the use of growing crops, keeping crop residue on the surface, and limiting tillage to keep the soil in good condition.

Structural measures, such as diversions and waterways, also are needed where excess water from adjacent areas is a problem.

Capability Unit IVe-2

This unit consists of gently sloping soils on uplands. These soils are moderately deep to deep and moderately to moderately slowly permeable. They are slightly subject to soil blowing and moderately to highly subject to water erosion. Their available water capacity is high.

Where small grain and sorghums are grown, the crop residue can be used to help control erosion. Limited tillage also conserves residue and moisture. Contour farming and terraces are needed to grow row

crops. Diversion terraces and grassed waterways are needed in places to dispose of runoff.

Capability Unit IVe-4

This unit consists of deep and moderately deep, gently sloping soils on uplands. These soils are moderately permeable. Their available water capacity is low to high, and the hazards of soil blowing and water erosion are moderate.

The soils in this unit are easily tilled and are best suited to small grain and sorghum. Growing crops or protective residue are needed on the surface of the soil during critical periods to control erosion. Limited tillage also is an important management practice. Terraces are needed to control water erosion. Diversion terraces control excess water from adjacent areas.

Capability Unit IVe-5

Spade fine sandy loam, 3 to 5 percent slopes, is the only soil in this unit. This soil is moderately deep, moderately permeable, and gently sloping. It is moderately susceptible to soil blowing and water erosion. The available water capacity is high.

Good management consists of using close-spaced or drilled sorghum and small grains to protect and maintain the soil. Limited tillage and conservation of residue help reduce erosion. Additional erosion control practices needed under cultivation are contour farming and terraces.

Capability Unit IVe-6

This unit consists of Miles loamy fine sand, 0 to 3 percent slopes. This soil is deep, moderately permeable, and nearly level to gently sloping. It is subject to a high hazard of soil blowing and a slight hazard of water erosion. The available water capacity is high.

Cotton and sorghum are the principal crops grown. Rotation of crops and careful use of fertilizer to maintain a high level of residue are useful management practices. Crop residue kept on the surface helps control soil blowing. Deep plowing can increase the clay content of the surface soil and reduce soil blowing. Cotton and sorghum grown in alternate strips further help reduce soil blowing, as does limited tillage.

Capability Unit IVe-9

The only soil in this unit is Berda fine sandy loam, 3 to 5 percent slopes. This soil is deep, moderately permeable, and gently sloping. It is subject to a moderate hazard of soil blowing and water erosion. It has a high available water capacity.

This soil is best suited to sorghum and small grain. These crops provide large amounts of residue for erosion control. Contour farming and terraces also help control water erosion.

Capability Unit IVe-11

Springer loamy fine sand, 0 to 3 percent slopes, is the only soil in this unit. This soil is deep and nearly level to gently sloping. Permeability is moderately rapid, and the soil is subject to a high hazard of soil blowing and water erosion. The available water capacity is moderate.

Only those crops that leave residue on the surface in an amount that controls soil blowing are suitable for this soil. Among these crops are drilled or close-spaced sorghum, small grains, and grasses. Minimum tillage and stubble mulching are useful practices.

Capability Unit Vw-1

This unit consists of Clairemont and Yahola soils, frequently flooded. These are deep, nearly level, moderately to moderately rapidly permeable soils on the flood plains of streams.

These soils are best suited to perennial grasses. Proper stocking rate, resting of pastures and the rotation of grazing help maintain vigorous, productive stands of grass. Brush, saltcedar, mesquite, and similar brushy plants should be controlled.

Capability Unit Vw-2

This unit consists only of Lincoln soils. These are deep, rapidly permeable, sandy soils on bottom lands. These soils are subject to flooding. When flooded, they are also subject to scouring and to deposition of new material over the surface. They are highly susceptible to soil blowing.

Lincoln soils are not well suited to cultivation. They are best suited to perennial grasses. Brush control, proper stocking rate, and cutting grasses for hay at the proper growth stage are important management practices for these soils.

Capability Unit VIe-1

This unit consists of only Vernon soils, sloping. These soils are moderately deep, well-drained, very slowly permeable, and gently sloping. They are moderately susceptible to water erosion.

All of these Vernon soils are in range. They are not suited to cultivation.

Capability Unit VIe-4

This unit consists of shallow to moderately deep, moderately to moderately rapidly permeable soils. These soils are medium textured and gently sloping to sloping (pl. VI, top).

The soils in this unit are not well suited to cultivation. Most are in range. Areas that were once cultivated have been seeded to perennial grasses. Good grazing management practices are use of proper stocking rate, the resting of pastures during part of the growing season, and brush control.

Capability Unit VIe-6

The soils in this unit are deep and moderately to moderately rapidly permeable. These soils are gently sloping to sloping. They are subject to a high hazard of soil blowing. The available water capacity is moderate to high.

Soils in this unit are not well suited to cultivation. They are best suited to perennial grasses.

Frequently, brush control is necessary. Good grazing management calls for not grazing during part of the growing season and maintaining a proper stocking rate.

Capability Unit VIe-7

This unit consists of deep, moderately to moderately rapidly and rapidly permeable soils. These soils are well-drained and are gently undulating to hummocky. They are highly susceptible to soil blowing and have a low to moderate available water capacity.

The soils in this unit are not well suited to crops. They are best suited to perennial grasses. Careful grazing management is needed to prevent soil blowing.

Capability Unit VIw-1

Randall clay is the only soil in this unit. This soil is deep and very slowly permeable. It is nearly level and somewhat poorly drained. It lies on the bottom of enclosed depressions or playas and is subject to flooding.

Slight soil blowing may occur where some areas are left bare by cultivation or where standing water has killed protective vegetation during long wet periods. This soil is best suited to perennial grasses. Good management practices are needed to control erosion.

Capability Unit VIIe-1

The only soil in this unit is Tivoli fine sand. This soil is deep, rapidly permeable dune sand. It is highly susceptible to soil blowing and has a low available water capacity.

This soil is best suited to range, wildlife, or recreational use. All of this Tivoli fine sand is in range. A good cover of vegetation must be maintained to prevent serious soil blowing.

Capability Unit VIIs-1

This unit consists of shallow to deep soils that are nearly level to broken and steep. These soils have a low to high available water capacity.

Soils in this unit are best suited to range, wildlife, or recreation. A good grass cover must be kept on these soils to prevent erosion. Careful consideration is needed in the location of roads or other improvements where traffic could create erosion.

Capability Unit VIIs-2

This unit consists of Rough broken land. The areas are steep, rough, broken, and highly susceptible to water erosion. Most areas support only a sparse cover of vegetation.

This unit is suitable only for range, wildlife, and recreation. Management of grass cover is important in controlling erosion. Erosion hazards can be reduced by careful location of roads, pens, and other improvements.

Predicted Yields

Crop yields over a period of years reflect the management the soil has received. Generally, continued high yields are a result of good management and an indication that the soil has been improved or is kept in good condition. In table 2 are predicted average acre yields for the principal crops grown in the county. The yields are based on acreage seeded and assume a high level of management for dryland soils. No yields are predicted for irrigated soils, because irrigation is limited in Kent County. Yields for crops under irrigation can normally be expected to be two to three times as much as those obtained under dryland farming.

Although crops other than those listed in table 2 are grown, their yields are not given because they are grown only in a small acreage and reliable data are not available. A high level of dryland management requires the following:

1. Conserving moisture by using a properly maintained terrace system, contour farming, and stubble-mulch tillage.
2. Using crop residues to control erosion.
3. Maintaining tilth by using a cropping system that provides an adequate supply of organic matter; tilling, harvesting, and grazing only when soil moisture is optimum to avoid compaction; minimum but timely tillage consistent with weed control and seedbed preparation; and varying the depth of tillage.
4. Controlling insects, diseases, and weeds.
5. Seeding improved varieties or strains of crops.

The estimates in table 2 are based on information obtained from farmers, on observations and comparisons made by those familiar with the soils, and on research. The only soils listed on table 2 are those on which crops are normally grown.

TABLE 2.--PREDICTED ACRE YIELDS OF PRINCIPAL CROPS

[Only parts of the county used for crops are listed in this table. Absence of a figure indicates that the crop is not commonly grown on the soil]

Soil	Cotton (lint)	Wheat	Grain sorghum
	Lbs.	Bu.	Lbs.
Abilene clay loam, 0 to 1 percent slopes	275	20	2,000
Berda fine sandy loam, 0 to 1 percent slopes	275	20	2,000
Berda fine sandy loam, 1 to 3 percent slopes	250	17	1,725
Berda fine sandy loam, 3 to 5 percent slopes	170	12	950
Clairemont silt loam	400	25	2,500
Cobb and Miles fine sandy loams, 1 to 3 percent slopes	220	18	1,500
Cobb and Miles fine sandy loams, 3 to 5 percent slopes	170	15	1,000
Enterprise very fine sandy loam, 1 to 3 percent slopes	275	20	2,000
Frio clay loam	400	20	3,000
Miles fine sandy loam, 0 to 1 percent slopes	275	20	1,750
Miles fine sandy loam, 1 to 3 percent slopes	230	17	1,200
Miles fine sandy loam, 3 to 5 percent slopes	200	15	1,100
Miles loamy fine sand, 0 to 3 percent slopes	200	15	1,200
Obaro loam, 1 to 3 percent slopes	275	20	2,000
Obaro loam, 3 to 5 percent slopes	200	12	1,100
Olton clay loam, 0 to 1 percent slopes	275	20	2,000
Olton clay loam, 1 to 3 percent slopes	225	15	1,500
Paducah loam, 1 to 3 percent slopes	275	20	2,000
Spade fine sandy loam, 1 to 3 percent slopes	200	15	1,500
Spade fine sandy loam, 3 to 5 percent slopes	---	10	1,000
Springer loamy fine sand, 0 to 3 percent slopes	180	13	1,000
Weymouth clay loam, 1 to 3 percent slopes	200	15	1,000
Weymouth clay loam, 3 to 5 percent slopes	---	10	750
Wichita silt loam, 1 to 3 percent slopes	225	15	1,500
Wichita silt loam, 3 to 5 percent slopes	200	10	1,000
Yahola very fine sandy loam	300	20	2,000

MANAGEMENT OF THE SOILS FOR RANGE[3/]

Ranching and livestock management are important enterprises in Kent County. About 87 percent of the county land area is in range. Eighty percent of the operating units in the county have 75 or more animal units of livestock for at least 6 months each year.

There are 48 ranches in the county. Ninety percent of these have some cropland. The primary crops grown are sorghum and wheat.

The most common livestock operation is the cow-calf enterprise. Many livestock operators supplement their operations with winter stockers or carry-over calves from the base herd during years of favorable forage production. Interest in feeding operations is growing. Silage is the primary forage fed.

Range Sites and Condition Classes

A range site is a distinctive kind of range that has the ability to produce significantly different amounts and kinds of plants. Each site is different enough to require management somewhat different from that of other sites, as for example, a different rate of stocking. The different kinds, proportions, and quantities of plants on different range sites are the result of such differences in environment as soil, topography, and climate.

3/ Prepared by GEORGE W. SULTEMEIER, field range conservationist, Soil Conservation Service.

A range site can be identified by the kinds of soil known to be capable of producing the distinctive potential plant community that characterizes the site. For example, the Deep Sand range site has potential to grow such grasses as sand bluestem, switchgrass, little bluestem, and side-oats grama. In contrast, the potential of the Deep Hardland site is to grow blue grama, buffalograss, and western wheatgrass.

The most productive combination of forage plants on a range site is generally the potential, or climax, type of vegetation. Most of the native grasslands have been heavily grazed for several generations and their original plant cover has been materially altered.

Range condition is the present state of the vegetation of a range site in relation to the potential plant cover for that site. Range Condition Classes measure the degree to which the present plant composition, expressed as a percentage, resembles that of the potential plant community of a range site.

Range condition is determined by comparing the kinds and numbers of plants that make up the vegetative cover with those in the potential native plant cover for the site. Range condition indicates the degree to which the composition of the existing plant community differs from the potential, or climax, vegetation. Four classes are recognized. A range is in excellent condition if 76 to 100 percent of the vegetation is the same kind as that in the original stand; it is in good condition if the percentage is between 51 and 75; in fair condition if the percentage is between 26 and 50; and in poor condition if the percentage is 25 or less.

In determining present range condition class, plants are grouped in accordance to their response to the intensity of grazing on specific range sites. These groups of plants are decreasers, increasers, and invaders.

Decreaser plants are species in the potential plant community that decrease in relative amount when such a community is subjected to continued moderately heavy to heavy grazing. Most of these decreaser plants have a high grazing palatability and decrease as a result of excessive use. The total of all such species is counted in determining range condition class.

Increaser plants are species present in the potential plant community that normally increase in relative abundance when the community is subjected to continued moderately heavy to heavy grazing. Some increasers with moderately high palatability may initially increase, and then decrease as grazing pressure continues. Others of low grazing preference may continue to increase either in actual plant numbers or in relative proportions. Only the percentages of increaser plants normally expected to occur in the potential plant community are counted in determining range condition.

Invader plants are not members of the potential plant community for the site. They invade the community as a result of excessive grazing and various other kinds of disturbance. These invaders may be annuals or perennials and may be grasses, weeds, or woody plants. Some have relatively high grazing value, but many are worthless. Invader plants are not counted in determining range condition class.

For most range sites and most range livestock operations, the higher the range condition class, the greater is the quality and amount of available forage.

Range condition is judged according to standards that apply to the particular range site. It expresses the kind and amount of vegetation present in relation to the climax, or potential, for that site. Forage potential depends upon the site.

Current production depends on the range condition and the moisture that the plants get during their growing season. Range production usually varies directly with range condition, but this is not always true. Yields of low quality plants may equal or exceed that of higher types of plants, but palatability and quality of forage will invariably be inferior at the lower range condition.

Descriptions of Range Sites

A range site is a distinctive kind of range that differs from other kinds in its potential to produce native plants. Soils are grouped in a particular range site according to their ability to produce specific kinds and amounts of plants. A range site may consist of one or more soil types, phases of soil types, or complexes of soil types or phases.

Thirteen distinct range sites have been described in Kent County. The climax vegetation and the principal invading plants are mentioned in the description of each site. Also given for each site is the total annual herbage yield for wet and dry years when the site is in good or excellent condition. Estimates of forage yield are based on range clippings and rancher experience. Approximately 1,300 acres, of little or no grazing value, have been identified as the "Badland" part of the Vernon-Badland complex, sloping. This land is not included in a range site. Randall clay is included with the range site adjacent to the area where it is actually located.

Loamy Bottomland Range Site

The soils of this site lie along stream courses, canyons, and draws. The extra water from overflow and drainage from adjacent lands, coupled with high fertility, make this one of the most productive range sites in the county.

This range site is capable of producing an abundance of tall and mid grasses when it is in good to excellent condition. Such trees as hackberry and cottonwood grow along the banks of the major streams. Rapid deterioration of the site results if grazing is prolonged. Tall grasses are first to die out under heavy grazing; next, the mid grasses are replaced by perennial weeds, many kinds of annuals, and heavy stands of brush.

The composition of the potential plant community, or climax vegetation, varies according to the origin of the alluvial deposits. About 70 percent is made up of the decreasers big bluestem, sand bluestem, little bluestem, indiangrass, switchgrass, Canada wildrye, and side-oats grama. The important increasers that make up 30 percent of the vegetation are western wheatgrass, vine-mesquite, Texas bluegrass, Texas wintergrass, blue grama, and meadow dropseed. If the site is saline, alkali sacaton is a part of the plant community and increases very rapidly as the site deteriorates.

If the climax vegetation is not maintained, noxious plants that develop from seed washed in from large outlying areas invade the site. These invaders are annual weeds common in cultivated fields. Among these are sunflower, cocklebur, buffalo-bur, hairy caltrop, common broomweed, crotons, thistles, and sandbur. Other common invaders are sand dropseed, three-awn, windmillgrass, Texas grama, hairy tridens, inland saltgrass in saline areas, and perennial forbs.

The loss of competitive grasses through overgrazing, which results because livestock prefer this site, enables mesquite and other brush to invade. The most effective means of controlling this brush is by basal treatment with oil or a combination of oil and chemical herbicide. Bulldozing of the more open stands is common.

This site responds favorably to range seeding where flooding is not a problem. The extra water received makes seeding less hazardous on this site than on upland sites.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 3,600 pounds in wet years to 2,000 pounds in dry years.

Sandy Bottomland Range Site

Lincoln soils are the only soils in this range site. They lie on bottom lands adjacent to larger rivers and streams that are active only during and after heavy rains.

Tall and mid grasses dominate where this site is in excellent condition. Sand bluestem and switchgrass are the most significant decreasers. Others are indiangrass, little bluestem, side-oats grama, and Canada wildrye.

The main climax increasers are western wheatgrass, vine-mesquite, meadow dropseed, silver bluestem, and alkali sacaton. Sand dropseed, three-awn, hooded windmillgrass, and buffalograss invade the site as it deteriorates. As the site deteriorates it is increasingly dominated by these invading grasses, annual weeds, and western ragweed, sand sagebrush, inland saltgrass, saltcedar, and mesquite.

In most places heavy grazing of the site has resulted in a decline to fair or poor condition. Heavy stands of mesquite dominate and constitute the major problem in range improvement.

The soils of this site respond to the control of brush, especially if there are desirable grasses left to benefit from the reduced competition. Mechanical control of mesquite and saltcedar is more effective than those methods requiring chemical spraying of the foliage. Basal application of oil and chemicals is effective in controlling tree-type mesquite on sandy soils.

Range seeding can be done on this site along with mechanical control of brush.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 3,800 pounds in wet years to 2,200 pounds in dry years.

Deep Hardland Range Site

The deep, loamy soils of this site are distributed over the county. These soils are smooth and nearly level to gently sloping. Crusting of the soil and formation of a "hoof pan," or compacted layer caused by trampling, reduce the intake of moisture in many places.

The potential plant community on this site consists of mid and short grasses. Blue grama, a decreaser, makes up a large percentage of the orignal vegetation. Other decreasers that occur in limited amounts are western wheatgrass, vine-mesquite, white tridens, and side-oats grama.

The main increasers that make up about 30 percent of the potential vegetation are buffalograss and silver bluestem.

Continuous overgrazing results in an immediate decrease in side-oats grama, followed by a decrease in blue grama, and then an increase in buffalograss. Further deterioration of the range results in invasion by perennial three-awn, hairy tridens, sand dropseed, Texas grama, tumblegrass, pricklypear, and numerous annual weeds.

In lower condition classes, and during especially wet springs, invading annuals cover the bare areas. The most common of these are Texas filaree, evax, various plantains, bladderpod, plains greenthread, bitterweed actinea, common broomweed, little barley, and Japanese brome. The common invading perennial forbs on this site are western ragweed, silverleaf nightshade, and Dakota verbena.

On this site, large amounts of litter and cover are required to reduce surface crusting and to control erosion. Where this site is in poor condition, recovery is slow because of crusting, heavy invasion by mesquite, and absence of desirable seed plants.

Brush control is effective on this site, and good recovery of grass may be expected if climax grasses are available in sufficent amounts for reseeding. Management of these grasses is an important part of treatment after brush control. Both mechanical and chemical brush control are effective.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 2,500 pounds in wet years to 1,500 pounds in dry years.

Sandy Loam Range Site

This site consists of nearly level and gently rolling soils on uplands. These soils support a wide variety of vegetation.

The variability in soil moisture on the site affects the proportions of short and mid grasses that make up the potential, or climax, vegetation. The climax decreasers are side-oats grama, little bluestem, Arizona cottontop, and plains bristlegrass.

The principal increasers that make up 25 to 30 percent of the potential vegetation are buffalograss, blue grama, sand dropseed, perennial three-awn, hairy grama, and silver bluestem. Woody increasers that form a maximum of 5 percent of the potential plant community are sand sagebrush and catclaw.

Undesirable grasses, weeds, and brush invade the site as it deteriorates. Such invaders are tumble windmillgrass, gummy lovegrass, red lovegrass, red grama, western ragweed, crotons, pricklypear, mesquite, and yucca.

Range management practices such as seeding, brush and water control, and proper grazing meet with good response. Where good range management is not practiced, brush encroaches and the site deteriorates.

Where this site is in good to excellent condition, the potential acre yield of air-dry herbage ranges from 2,550 pounds in wet years to 1,600 pounds in dry years.

Deep Sand Range Site

This site consists of deep sandy soils that are highly susceptible to soil blowing if unprotected by vegetation. The site deteriorates under continued heavy grazing but responds favorably to good management.

The potential plant community is predominantly tall grass, with lesser amounts of mid grass. Decreasers that make up 75 percent of the original vegetation are sand bluestem, indiangrass, little bluestem, switchgrass, sand lovegrass, and giant dropseed. Important increasers that make up 25 percent of the original vegetation are side-oats grama, silver bluestem, hairy grama, sand dropseed, and perennial three-awns. Such woody plants as sand plum, shin oak, and skunkbush also grow on this site.

As the site deteriorates, invading grasses and other plants increase. The principal invaders are gummy lovegrass, tumblegrass, red lovegrass, fringed signalgrass, yucca, sand sagebrush, groundsels, queensdelight, and sandbur. All soils of this Deep Sand range site respond to brush control.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 1,500 pounds in dry years.

Mixedland Range Site

The gently sloping to sloping soils in this site are deep to shallow.

About 70 percent of the vegetation consists of climax decreasers. Blue grama is the dominant species, and others are little bluestem, Arizona cottontop, plains bristlegrass, and side-oats grama. Canada wildrye, switchgrass, and western wheatgrass grow along the larger drains. Little bluestem grows only in isolated areas that contain gypsum and in areas that receive more moisture, such as some of the shallow soils fed by springs. Approximately 30 percent of the potential vegetation is increasers. These are buffalograss, hairy grama, sand dropseed, silver bluestem, and along drains, meadow dropseed.

Any deterioration in the vegetation results in an immediate decrease in side-oats grama, Arizona cottontop, and plains bristlegrass. Blue grama is next to decrease. Under heavy grazing pressure, the grama survives only on protected areas. If continuously overgrazed, the range vegetation soon consists of buffalograss and numerous invading forbs. Chief among the invading grasses are red grama, Texas grama, sixweeks grama, tumble windmillgrass, hooded windmillgrass, gummy lovegrass, little barley, tumblegrass, and hairy tridens. Woody invaders are mesquite, pricklypear, tasajillo, yucca, and juniper. Vegetation on the Quinlan soils is generally less dense than on other soils of the site.

This site is capable of moderate production of forage if it is in good to excellent condition. Where it is in excellent condition, the potential acre yield of air-dry herbage ranges from 2,400 pounds in wet years to 1,500 pounds in dry years.

Rough Breaks Range Site

This range site consists of nearly level to steep soils that are mostly inaccessible to livestock.

Where this site is in good to excellent condition, the plant cover consists of decreasers such as side-oats grama, little bluestem, and blue grama. Switchgrass, sand bluestem, indiangrass, and Canada wildrye grow in places that receive more moisture.

Increasers that make up 30 percent of the total potential vegetation are hairy grama, perennial three-awns, slim tridens, and sand dropseed. Woody increasers that grow on the slopes are redberry juniper, feather dalea, skunkbush, and catclaw acacia. Invaders of the site are Texas grama, hairy tridens, sand muhly, and numerous annual weeds.

Steep slopes prevent this site from being grazed. If this site is grazed heavily, surrounding range sites are likely overgrazed.

Even where in excellent condition, the density of plant cover is sparse. Under prolonged heavy use, these steep slopes lose their protective cover of vegetation and erosion accelerates. Under such conditions, soil loss is severe. Intense management and protection practices must be applied for stabilization, because little can be done to treat this site once vegetation is removed.

The total yield is less than that of surrounding sites. Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 1,000 pounds in wet years to 500 pounds in dry years.

Sandyland Range Site

This site consists of deep sandy soils. Tall grasses and occasional shin oak motts characterize this site. Where the site has deteriorated, short shin oak is prominent, and a wide variety of low producing perennials and annual weeds replace the declining tall grasses.

About 75 percent of the potential plant community consists of the decreasers sand bluestem, switchgrass, indiangrass, little bluestem, Canada wildrye, sand lovegrass, side-oats grama, and Texas bluegrass. Approximately 25 percent is made up of the increasers silver bluestem, sand dropseed, hairy grama, blue grama, and perennial three-awn. A few woody plants such as sand plum, sagebrush, and shin oak form a part of the climax vegetation on some soils in this site.

Any deterioration in this site results in a rapid increase of yucca, shin oak, and annual weeds. Invading grasses are annual three-awn, fringed signalgrass, tumble windmillgrass, gummy lovegrass, red lovegrass, tumble lovegrass, and low growing paspalums. The chief invading weeds are common ragweed, wax goldenweed, tumble ringwing, annual wildbuckwheat, rosering gaillardia, prairie sunflower, woollywhite, beebalm, pricklepoppy, curlycup gumweed, and Riddell groundsel.

On many ranches, woody invader plants such as shin oak and mesquite must be controlled before grasses can recover (pl. VI, bottom). Good range management after control of brush allows most areas of this site to regain good to excellent condition. Recovery requires a few years and is possible only if a seed source is available. If response is slow, overseeding by the best known methods speeds recovery.

Where this site is in excellent condition, the potential acre yields of air-dry herbage ranges from 3,200 pounds in wet years to 1,500 pounds in dry years.

Shallow Redland Range Site

The Shallow Redland range site is in rougher terrain, close to the rough broken watershed areas of the main stream courses.

The soils in this site are moderately deep and very slowly to moderately permeable. On these soils, a good plant cover is needed to help reduce evaporation and control water erosion.

The potential plant community consists mostly of mid and short grasses. Decreasers make up about 65 percent of the plant community. Side-oats grama is the dominant decreaser. Others are blue grama, vine-mesquite, and little bluestem. Sand bluestem and indiangrass grow in some areas.

Forbs in the potential plant community are groundplum milkvetch, dalea, prairie-clover, scurfpea, heath aster, Engelmanndaisy, dotted gayfeather, penstemon, sagewort, and gaura. These forbs are important indicators in determining trends in the condition of the range. Desert shrubs, such as acacia, mimosa, vine ephedra, agarito, and skunkbush, also are present.

Increasers make up about 35 percent of the vegetation. Important increasers are hairy grama, silver bluestem, buffalograss, perennial three-awn, and tobosa.

The chief woody invaders of this site are mesquite, pricklypear, and lotebush. Common invading perennial grasses are hairy tridens, sand dropseed, Texas grama, red grama, and tumblegrass. The chief invading forbs are broom snakeweed, wavyleaf thistle, plains actinea, gray goldaster, rock daisy, threadleaf groundsel, and Texas stillingia. Other common invading forbs are common broomweed, bitterweed actinea, oneseed croton, Texas filaree, evax, plantain, plains greenthread, and bladderpod.

Where this site is in good to excellent condition, the potential acre yield of air-dry herbage ranges from 1,600 pounds in wet years to 900 pounds in dry years.

Clay Flats Range Site

Mangum clay is the only soil in this site. It is on bottom lands along major rivers and creeks. This site receives extra water both from overflow and runoff from adjacent lands.

The climax vegetation is mid and short grasses. The decreasers are side-oats grama, blue grama, western wheatgrass, vine-mesquite, and white tridens. These decreasers make up a smaller percentage of the potential plant community than the increasers, which are tobosa, buffalograss, and alkali sacaton.

As the site deteriorates, tobosa and alkali sacaton become dominant. The site maintains this plant cover at the expense of almost all other grasses. Mesquite may invade the site but does not pose a serious problem. Other invading plants are pricklypear, cholla, and condalia.

Year-round grazing of this site results in very selective use of the better quality plants, because the tobosa and alkali sacaton are palatable for only a limited time. The selective grazing hastens deterioration of climax plants and speeds the increase of tobosa and alkali sacaton.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 2,000 pounds in wet years to 900 pounds in dry years.

Very Shallow Range Site

Latom soils, rolling, are the only soils in this site. These soils are on ridges and knobs elevated above the surrounding plains. In most places the cover of vegetation is not dense enough to protect the soil from erosion.

Where in excellent condition, the vegetation of the site has a mid grass aspect. Some short and tall grasses, however, grow on the variable soils of the site. The important decreasers are side-oats grama, blue grama, Arizona cottontop, plains

bristlegrass, vine-mesquite, little bluestem, and sand bluestem. The important increasers are hairy grama, black grama, buffalograss, silver bluestem, perennial three-awn, and slim or rough tridens.

As the range condition deteriorates, hairy tridens, Texas grama, Texas dropseed, pricklypear, mesquite, yucca, and redberry juniper invade.

Because the topography is rolling and the soils are shallow, little treatment is applicable other than good range management. The control of invading brush is feasible in some places, but the removal of this brush may contribute to the hazard of erosion on the site and should be considered with caution.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 1,100 pounds in wet years to 500 pounds in dry years.

Gypland Range Site

Cottonwood soils are the only soils in this site. The large amount of gypsum in these soils affects the vegetation on the site. The gypsum is in solid strata below the surface or is the surface as blisters. In some areas, limestone is interspersed with or adjacent to the soils.

Except in areas of almost pure gypsum, this site has mid and tall grasses. The main grasses are little bluestem and side-oats grama. Other decreasers on the site are blue grama, indiangrass, switchgrass, vine-mesquite, plains bristlegrass, and Arizona cottontop. Decreasers make up approximately 60 percent of the potential vegetation.

In addition to the dominant hairy grama, increasers on this range site are buffalograss, slim or rough tridens, Reverchon's bristle panicgrass, black grama, silver bluestem, sand dropseed, and perennial three-awn. Also characteristic of the site are dotted gayfeather and black feather dalea.

The principal invaders are mesquite, redberry juniper, yucca, catclaw, Texas grama, hairy tridens, and false-broomweed.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 1,100 pounds in wet years to 500 pounds in dry years.

Gravelly Range Site

Gently sloping to hilly soils, having gravel intermixed throughout the profile, make up this site. These soils are on hills and knolls.

Vegetation is varied but sparse. As the site deteriorates and erosion removes the topsoil, the ability of the site to produce vegetation is greatly reduced.

The decreasers that make up 70 percent of the potential plant community are side-oats grama, blue grama, little bluestem, and Arizona cottontop. Lesser amounts of sand bluestem, indiangrass, and switchgrass also grow on the site.

Increasers are hairy grama, buffalograss, silver bluestem, Texas wintergrass, and small amounts of shin oak.

Invaders are Texas grama, sand muhly, hairy tridens, false switchgrass, agarito, redberry juniper, catclaw, pricklypear, and numerous annual weeds. Mesquite invades the deeper soils and the few small depressional areas that occur in this range site.

Where this site is in good to excellent condition, the potential acre yield of air-dry herbage ranges from 1,600 pounds in wet years to 800 pounds in dry years.

ENGINEERING USES OF THE SOILS[4/]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built. Discussed in this section are those properties of the soils that affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, shear strength, density, shrink-swell potential, water-holding capacity; grain-size distribution, plasticity, and reaction.

Information concerning these and related soil properties is in tables 3 and 4.

The estimates and interpretations of soil properties in these tables can be used in--

1. Planning and designing of agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soils.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. The estimated values for bearing capacity and traffic supporting capacity expressed in words should not be assigned specific values. Estimates are generally made to depths of about 5 feet, and interpretations do not apply to greater depths. There are small areas of other soils included in the mapping units that may have different engineering properties than those listed. Even in these situations, however, the soil map is useful in planning more

4/ Prepared by DOUG BARTOSH, civil engineer, Soil Conservation Service.

TABLE 3.--ESTIMATED SOIL PROPERTIES

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or this reason it is necessary to follow carefully the instructions for referring to other series that appear broken land]

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Classification		
				USDA texture	Unified	AASHO
		Inches	Inches			
Abilene: AbA----------	C	>60	0-14	Clay loam----------	CL	A-6
			14-40	Clay----------	CL	A-6, A-7
			40-64	Clay loam----------	CL	A-6, A-7
Berda: BdA, BdB, BdC-------	B	>60	0-12	Fine sandy loam---------	SM	A-4
			12-36	Sandy clay loam---------	SC	A-4
			36-60	Fine sandy loam---------	SM	A-2
*Breaks: Bk. Properties too variable to rate. For Yahola part of Bk, see Yahola series.						
*Brownfield: BtB---------- For Tivoli part of BtB, see Tivoli series.	A	>60	0-26	Fine sand----------	SP-SM, SM	A-2
			26-48	Sandy clay loam---------	SC	A-6
			48-70	Loamy fine sand---------	SM	A-2
			70-84	Fine sandy loam---------	SM	A-4
*Clairemont: Ca, Cf-------- For Yahola part of Cf, see Yahola series.	B	>60	0-8	Silt loam----------	ML	A-6
			8-60	Silty clay loam---------	ML-CL	A-6
*Cobb: CmB, CmC---------- For Miles part of CmB and CmC, see Miles series.	B	20-48	0-8	Fine sandy loam---------	SM	A-4
			8-42	Sandy clay loam---------	SC, CL	A-6
			42-50	Partially weathered coarse sandstone.		
Cottonwood: Co----------	C	3-10	0-6	Loam----------	CL	A-4
			6-60	Hard gypsum.		
Enterprise: EnB----------	B	>60	0-64	Very fine sandy loam----	ML	A-4
Frio: Fr----------	B	>60	0-64	Clay loam----------	CL	A-6, A-7
Latom: LaC----------	D	4-20	0-8	Gravelly sandy loam-----	SM	A-2
			8-12	Indurated conglomerate and sandstone.		
Lincoln: Ln----------	A	>60	0-60	Fine sand and loamy fine sand.	SM	A-2
Mangum: Ma----------	D	>60	0-60	Clay----------	CL or CH	A-6 or A-7

more kinds of soil. The soils in such mapping units may have different properties and limitations, and for in the first column of this table. Symbol > means more than; < means less than. No estimations for Rough

Percentage passing sieve--				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Inches per hour	Inches per inch of soil		
100	100	95-99	75-85	0.63-2.00	0.14-0.16	6.6-7.8	Moderate.
100	100	95-99	90-95	0.20-0.63	0.14-0.18	7.4-8.4	Moderate.
100	90-100	90-98	70-85	0.63-2.00	0.12-0.16	7.9-8.4	Moderate.
95-100	90-100	85-95	35-45	2.00-6.30	0.10-0.12	7.9-8.4	Low.
95-100	90-100	85-95	35-50	0.63-2.00	0.12-0.16	7.9-8.4	Low.
95-100	90-100	85-95	20-35	2.00-6.30	0.08-0.12	7.9-8.4	Low.
100	100	95-100	5-15	6.30-20.00	0.06-0.08	6.1-7.3	Low.
100	100	95-100	35-45	0.63-2.00	0.12-0.16	6.1-6.5	Low.
100	100	70-85	20-35	2.00-6.30	0.06-0.08	6.6-7.3	Low.
100	100	80-95	35-45	2.00-6.30	0.10-0.12	7.4-7.8	Low.
100	100	100	85-95	0.63-2.00	0.16-0.19	7.9-8.4	Low.
100	100	100	85-95	0.63-2.00	0.16-0.19	7.9-8.4	Low.
100	98-100	75-90	40-50	2.00-6.30	0.10-0.14	6.6-7.3	Low.
95-100	90-99	90-98	45-60	0.63-2.00	0.12-0.16	6.6-7.8	Low.
100	100	85-95	55-70	0.63-2.00	0.12-0.14	7.9-8.4	Low.
100	100	95-99	80-90	2.00-6.30	0.18-0.20	7.4-8.4	Low.
95-100	95-100	75-90	70-95	0.20-0.63	0.15-0.18	7.9-8.4	Moderate.
70-100	65-95	60-80	25-35	0.63-2.00	0.10-0.14	7.9-8.4	Low.
100	95-100	55-70	15-35	6.30-20.00	0.05-0.06	7.9-8.4	Low.
95-100	95-100	85-95	80-95	<0.06	0.14-0.18	7.9-8.4	High.

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Classification		
				USDA texture	Unified	AASHO
		Inches	Inches			
Miles:						
MnA, MnB, MnC, MsC2------	B	>60	0-10	Fine sandy loam--------	SM	A-2, A-4
			10-80	Sandy clay loam--------	SC, CL	A-6
			80-90	Fine sandy loam--------	SM	A-2, A-4
MlB, MlD----------	B	>60	0-16	Loamy fine sand--------	SM	A-2
			16-54	Sandy clay loam--------	SC or CL	A-6
			54-80	Fine sandy loam--------	SM	A-2, A-4
*Nobscot: Nb, NtB--------- For Brownfield part of Nb, see Brownfield series; for Tivoli part of NtB, see Tivoli series.	A	>60	0-34	Fine sand----------	SP-SM	A-3
			34-58	Fine sandy loam--------	SM	A-4
			58-72	Fine sand----------	SP-SM	A-3
Obaro: ObB, ObC----------	B	20-48	0-30	Loam----------	ML-CL, CL	A-4, A-6
			30-60	Weakly cemented calcareous sandstone.	ML-CL	A-4
Olton: OcA, OcB----------	C	>60	0-7	Clay loam----------	CL	A-4, A-6
			7-55	Clay loam----------	CL	A-6, A-7
			55-60	Silt loam----------	CL, ML-CL	A-6
Paducah: PaB----------	B	>60	0-9	Loam----------	ML	A-4
			9-38	Sandy clay loam--------	ML or CL	A-6
			38-64	Loam----------	ML or CL	A-4
*Polar: PgB, PhD---------- For Berda part of PhD, see Berda series.	B	>60	0-7	Gravelly sandy loam----	GM or SM, SP-SM	A-1 or A-2
			7-60	Very gravelly sandy loam.	GM-GC, SP-SM or SM	A-1 or A-2
Quinlan: QuC----------	C	10-20	0-16	Very fine sandy loam---	ML	A-4
			16-36	Weakly cemented sandstone.		
Randall: Ra----------	D	>60	0-8	Clay----------	CL or CH	A-6 or A-7
			8-64	Clay----------	CL or CH	A-6 or A-7
Spade: SdB, SdC----------	B	20-48	0-34	Fine sandy loam--------	SM	A-2, A-4
			34-38	Weakly and strongly cemented sandstone.		
Springer: SgB, SgD--------	B	>60	0-16	Loamy fine sand--------	SM	A-2
			16-42	Sandy loam----------	SM or SC	A-2
			42-56	Loamy sand----------	SM	A-2
			56-84	Sandy loam----------	SM or SC	A-2
Tivoli: Tv----------	A	>60	0-60	Fine sand----------	SP-SM	A-2 or A-3
*Vernon: VeC, VrC---------- No estimates for Badland part of VrC.	D	20-30	0-6	Clay loam----------	CL	A-6
			6-18	Clay----------	CH, CL	A-7
			18-26	Shaly clay----------	CL, CH	A-6, A-7
			26-42	Unweathered clayey shale.		

SIGNIFICANT IN ENGINEERING--Continued

Percentage passing sieve--				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Inches per hour	Inches per inch of soil		
95-100	90-100	80-95	25-40	2.00-6.30	0.10-0.14	6.6-7.3	Low.
98-100	95-100	90-97	45-60	0.63-2.00	0.13-0.17	6.6-8.4	Low.
95-100	90-100	80-95	25-40	2.00-6.30	0.10-0.12	7.9-8.4	Low.
95-100	90-100	80-95	15-35	2.00-6.30	0.08-0.10	6.6-7.3	Low.
98-100	95-100	90-97	45-60	0.63-2.00	0.12-0.16	7.4-7.8	Low.
95-100	90-100	80-95	25-40	2.00-6.30	0.10-0.12	7.4-7.8	Low.
100	100	65-80	5-10	6.30-20.00	0.04-0.06	6.1-6.5	Low.
100	100	90-100	35-50	2.00-6.30	0.10-0.13	6.1-6.5	Low.
100	100	65-80	5-10	6.30-20.00	0.04-0.06	6.6-7.3	Low.
95-98	92-97	90-96	75-85	0.63-2.00	0.12-0.16	7.9-8.4	Low.
95-99	90-99	90-98	60-75	0.63-2.00	0.04-0.08	7.9-8.4	Low.
100	95-100	90-100	55-75	0.63-2.00	0.15-0.20	7.4-7.8	Low.
100	90-100	90-100	70-85	0.20-0.63	0.15-0.20	7.4-8.4	Moderate.
90-100	90-100	90-100	60-75	0.20-0.63	0.10-0.15	7.9-8.4	Moderate.
100	100	95-100	50-65	0.63-2.00	0.16-0.20	7.4-7.8	Low.
100	96-99	95-99	55-65	0.63-2.00	0.15-0.19	7.4-8.4	Low.
100	96-99	95-100	55-65	0.63-2.00	0.15-0.19	7.9-8.4	Low.
45-75	35-60	30-50	10-25	2.00-6.30	0.04-0.09	7.9-8.4	Low.
40-75	25-55	20-45	5-15	2.00-6.30	0.03-0.07	7.9-8.4	Low.
100	100	85-95	50-65	2.00-6.30	0.12-0.14	7.9-8.4	Low.
100	100	95-100	80-95	<0.06	0.18-0.20	6.6-8.4	High.
100	100	90-95	75-90	<0.06	0.18-0.20	6.6-8.4	High.
95-100	95-100	75-90	30-50	2.00-6.30	0.10-0.14	7.9-8.4	Low.
100	100	70-85	10-25	6.30-20.00	0.08-0.10	6.6-7.3	Low.
100	100	80-95	15-35	2.00-6.30	0.10-0.14	7.4-7.8	Low.
100	100	70-85	10-25	2.00-6.30	0.08-0.10	7.4-7.8	Low.
100	100	80-95	20-35	2.00-6.30	0.10-0.14	7.4-7.8	Low.
100	100	65-80	5-10	6.30-20.00	0.05-0.07	6.6-8.4	Low.
95-100	95-100	70-85	60-75	0.20-0.63	0.12-0.15	7.9-8.4	Moderate.
95-100	95-100	90-100	80-95	<0.06	0.13-0.17	7.9-8.4	High.
90-100	90-100	90-100	70-90	<0.06	0.08-0.12	7.9-8.4	High.

TABLE 3.--ESTIMATED SOIL PROPERTIES

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Classification		
				USDA texture	Unified	AASHO
		Inches	Inches			
Weymouth: WeB, WeC--------	B	>60	0-6	Clay loam----------	CL	A-6
			6-28	Clay loam----------	CL	A-6
			28-48	Clay loam----------	CL	A-6
Wichita: WhB, WhC---------	C	>60	0-7	Silt loam----------	ML-CL	A-4
			7-64	Silty clay loam--------	ML-CL	A-7
			64-70	Silt loam----------	ML-CL	A-6
*Woodward: WoC---------- For Quinlan part of WoC, see Quinlan series.	B	24-48	0-60	Very fine sandy loam---	ML	A-4
Yahola: Ya----------	B	>60	0-15	Very fine sandy loam---	ML	A-4
			15-60	Fine sandy loam--------	SC or ML	A-4 or A-6

SIGNIFICANT IN ENGINEERING--Continued

Percentage passing sieve--				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	Inches per inch of soil		
95-100	95-100	90-100	60-75	0.63-2.00	0.14-0.16	7.9-8.4	Moderate.
90-95	85-95	75-85	55-70	0.63-2.00	0.14-0.16	7.9-8.4	Moderate.
95-100	95-100	90-100	60-75	0.63-2.00	0.14-0.16	7.9-8.4	Moderate.
100	100	90-100	70-85	0.63-2.00	0.14-0.18	7.4-7.8	Moderate.
100	100	95-100	75-95	0.20-0.63	0.16-0.20	7.4-8.4	Moderate.
100	100	90-100	70-85	0.63-2.00	0.14-0.18	7.4-8.4	Moderate.
95-100	95-100	90-100	55-85	0.63-2.00	0.12-0.15	7.9-8.4	Low.
100	100	85-95	50-65	2.00-6.30	0.12-0.15	7.9-8.4	Low.
100	100	80-95	45-60	2.00-6.30	0.10-0.12	7.9-8.4	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS OF

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two this reason it is necessary to follow carefully the instructions for referring to other series that appear variable for the material to be classified. No interpretations made for Badlands, Breaks, and Rough broken

Soil series and map symbols	Suitability as a source of--		Degree of limitations and soil features affecting--			
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Abilene: AbA---	Fair: clay loam texture.	Fair: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.	None to slight.
Berda: BdA, BdB, BdC.	Fair: 6 to 14 inches of fine sandy loam.	Fair: fair traffic supporting capacity.	Moderate: fair traffic supporting capacity.	None to slight.	Slight-------	Moderate: moderate permeability.
* Breaks: Bk. For Yahola part of Bk, see Yahola series.						
* Brownfield: BtB- For Tivoli part of BtB, see Tivoli series.	Poor: fine sand texture.	Good----------	None to slight.	None to slight.	Slight-------	Moderate: moderate permeability.
* Clairemont: Ca, Cf. For Yahola part of Cf, see Yahola series.	Fair: 4 to 14 inches of silt loam.	Fair: fair traffic supporting capacity.	Severe: flood hazard.	Severe: flood hazard.	Severe: flood hazard.	Moderate: moderate permeability.
* Cobb: CmB, CmC-- For Miles part of CmB and CmC, see Miles series.	Fair: 4 to 10 inches of fine sandy loam.	Fair: fair traffic supporting capacity.	Moderate: fair traffic supporting capacity.	None to slight.	Severe: bedrock at depth of 20 to 48 inches.	Severe: bedrock at depth of 20 to 48 inches.
Cottonwood: Co--	Poor: 3 to 10 inches of loam.	Poor: 3 to 10 inches of material.	Severe: bedrock at depth of 3 to 10 inches.	Severe: bedrock at depth of 3 to 10 inches.	Severe: bedrock at depth of 3 to 10 inches.	Severe: bedrock at depth of 3 to 10 inches.

or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for in the first column of this table. Absence of entry in a column indicates that characteristics are too land]

Degree of limitations and soil features affecting--Continued		Soil features affecting			Degree of corrosivity and contributing soil features	
Farm ponds		Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
Reservoir area	Embankments					
Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Moderate intake rate.	Features generally favorable.	Features generally favorable.	Moderate: clay loam texture.	Low.
Moderate: moderate permeability.	Moderate: medium compressibility.	Slope----------	Features generally favorable.	Features generally favorable.	Moderate: conductivity.	Low.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Rapid intake rate.	Severe: hazard of soil blowing; undulating and hummocky topography.	Severe: hazard of soil blowing.	Moderate: sandy clay loam texture in the subsoil.	Low.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Flood hazard---	Flood hazard---	Flood hazard---	Low----------	Low.
Severe: bedrock at depth of 20 to 48 inches.	Moderate: fair resistance to piping and erosion.	Bedrock at depth of 20 to 48 inches.	Bedrock at depth of 20 to 48 inches.	Bedrock at depth of 20 to 48 inches.	Low----------	Low.
Severe: bedrock at depth of 3 to 10 inches.	Severe: bedrock at depth of 3 to 10 inches.	Bedrock at depth of 3 to 10 inches.	Bedrock at depth of 3 to 10 inches.	Bedrock at depth of 3 to 10 inches.	High: conductivity.	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as a source of--		Degree of limitations and soil features affecting--			
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Enterprise: EnB	Good----------	Fair: fair traffic supporting capacity.	Moderate: fair traffic supporting capacity.	None to slight.	Slight: where slopes are 1 to 2 percent; moderate where slopes are 2 to 3 percent.	Severe: moderately rapid permeability.
Frio: Fr-------	Fair: clay loam texture.	Fair: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic supporting capacity; moderate shrink-swell potential.	Severe: flood hazard.	Severe: flood hazard.	None to slight.
Latom: LaC-----	Poor: 30 percent coarse fragments.	Poor: 4 to 20 inches of material.	Severe: bedrock at depth of 4 to 20 inches.	Severe: bedrock at depth of 4 to 20 inches.	Severe: bedrock at depth of 4 to 20 inches.	Severe: bedrock at depth of 4 to 20 inches.
Lincoln: Ln----	Poor: fine sand texture.	Good----------	Severe: flood hazard.	Severe: flood hazard.	Severe: flood hazard.	Severe: rapid permeability.
Mangum: Ma-----	Poor: clay texture.	Poor: poor traffic supporting capacity; high shrink-swell potential.	Severe: poor traffic supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	None to slight.
Miles: MnA, MnB, MnC, MsC2.	Fair: 7 to 14 inches of fine sandy loam.	Fair: fair traffic supporting capacity.	Moderate: fair traffic supporting capacity.	None to slight.	Slight--------	Moderate: moderate permeability.
MlB, MlD------	Poor: loamy fine sand texture.	Fair: fair traffic supporting capacity.	Moderate: fair traffic supporting capacity.	None to slight.	Slight where slopes are 0 to 5 percent; moderate where slopes are 5 to 8 percent.	Moderate: moderate permeability.

OF SOIL PROPERTIES--Continued

Degree of limitations and soil features affecting--Continued		Soil features affecting--			Degree of corrosivity and contributing soil features	
Farm ponds		Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
Reservoir area	Embankments					
Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately high intake rate.	Features generally favorable.	Features generally favorable.	Low----------	Low.
Moderate: moderately slow permeability.	Moderate: medium compressibility.	Features generally favorable.	Features generally favorable.	Features generally favorable.	High: clay loam texture.	Low.
Severe: bedrock at depth of 4 to 20 inches.	Severe: 4 to 20 inches of material.	Bedrock at depth of 4 to 20 inches.	Bedrock at depth of 4 to 20 inches.	Bedrock at depth of 4 to 20 inches.	Low----------	Low.
Severe: rapid permeability.	Moderate: fair resistance to piping and erosion.	Rapid intake rate.	Soil blowing hazard; flood hazard.	Soil blowing hazard; flood hazard.	Low----------	Low.
None to slight.	Moderate: fair resistance to piping and erosion.	Slow intake rate.	Features generally favorable.	Features generally favorable.	High: clay texture.	Low.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.	Low----------	Low.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Rapid intake rate.	Soil blowing hazard.	Soil blowing hazard.	Low----------	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as a source of--		Degree of limitations and soil features affecting--			
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
*Nobscot: Nb, NtB. For Brownfield part of Nb, see Brownfield series; for Tivoli part of NtB, see Tivoli series.	Poor: fine sand texture.	Good----------	Slight--------	None to slight.	Slight--------	Severe: moderately rapid permeability.
Obaro: ObB, ObC	Good----------	Fair: fair traffic supporting capacity.	Moderate: fair traffic supporting capacity.	None to slight.	Severe: bedrock at depth of 20 to 48 inches.	Severe: bedrock at depth of 20 to 48 inches.
Olton: OcA, OcB	Fair: clay loam texture.	Fair: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Moderate: moderately slow permeability.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 3 percent.
Paducah: PaB----	Fair: 6 to 14 inches of loam.	Fair: fair traffic supporting capacity.	Moderate: fair traffic supporting capacity.	None to slight.	Moderate: moderate permeability.	Moderate: moderate permeability.
*Polar: PgB, PhD For Berda part of PhD, see Berda series.	Poor: 40 to 65 percent coarse fragments.	Good----------	Slight where slopes are 1 to 6 percent; moderate where slopes are 6 to 15 percent; severe where slopes are 15 to 40 percent.	Slight where slopes are 1 to 6 percent; moderate where slopes are 6 to 15 percent; severe where slopes are 15 to 40 percent.	Slight where slopes are 1 to 5 percent; moderate where slopes are 5 to 10 percent; severe where slopes are 10 to 40 percent.	Severe: moderately rapid permeability.
Quinlan: QuC-----	Moderate: 10 to 20 inches of very fine sandy loam.	Poor: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.

OF SOIL PROPERTIES--Continued

Degree of limitations and soil features affecting--Continued		Soil features affecting--			Degree of corrosivity and contributing soil features	
Farm ponds		Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
Reservoir area	Embankments					
Severe: moderately rapid permeability.	Severe: poor slope stability; moderately rapid permeability.	Rapid intake rate.	Soil blowing hazard.	Soil blowing hazard.	Low----------	Low.
Severe where bedrock is at depth of 20 to 36 inches; moderate where bedrock is at depth of 36 to 48 inches.	Moderate: fair resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.	Low----------	Low.
Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.	Moderate: clay loam texture.	Low.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.	Moderate: clay loam texture.	Low.
Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Gravelly surface; slope.	Slope----------	Slope----------	Low----------	Low.
Severe: bedrock at depth of 10 to 20 inches.	Severe: less than 20 inches of borrow material.	Bedrock at depth of 10 to 20 inches.	Bedrock at depth of 10 to 20 inches.	Bedrock at depth of 10 to 20 inches.	Low----------	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as a source of--		Degree of limitations and soil features affecting--			
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Randall: Ra----	Poor: clay texture.	Poor: poor traffic supporting capacity; high shrink-swell potential.	Severe: poor traffic supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	None to slight.
Spade: SdB, SdC.	Good----------	Poor where bedrock is at depth of 20 to 24 inches; fair where bedrock is at depth of 24 to 48 inches.	Severe where bedrock is at depth of 20 to 36 inches; slight where bedrock is at depth of 36 to 48 inches.	None to slight.	Severe: bedrock at depth of 20 to 48 inches.	Severe: moderately rapid permeability.
Springer: SgB, SgD.	Poor: 10 to 20 inches of loamy fine sand.	Good----------	Moderate: fair traffic supporting capacity.	None to slight.	Slight where slopes are 0 to 5 percent; moderate where slopes are 5 to 8 percent.	Severe: moderately rapid permeability.
Tivoli: Tv-----	Poor: fine sand texture.	Good----------	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 15 percent; severe where slopes are 15 to 40 percent.	None to slight.	Slight where slopes are 0 to 5 percent; moderate where slopes are 5 to 10 percent; severe where slopes are 10 to 40 percent.	Severe: rapid permeability.
*Vernon: VeC, VrC. No interpretations made for Badland part of VrC.	Poor where 5 to 6 inches of clay loam; fair where 6 to 9 inches of clay loam.	Poor: poor traffic supporting capacity; high shrink-swell potential.	Severe: poor traffic supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight where slopes are 1 to 2 percent; moderate where slopes are 2 to 7 percent; severe where slopes are 7 to 8 percent.

OF SOIL PROPERTIES--Continued

Degree of limitations and soil features affecting--Continued		Soil features affecting--			Degree of corrosivity and contributing soil features	
Farm ponds		Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
Reservoir area	Embankments					
None to slight.	Moderate: fair resistance to piping and erosion.	Very slow intake rate.	Features generally favorable.	Features generally favorable.	High: clay texture.	Low.
Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately rapid intake rate.	Erosion hazard-	Erosion hazard-	Low----------	Low.
Severe: moderately rapid permeability.	Moderate: fair resistance to piping and erosion.	Moderately rapid intake rate.	Soil blowing hazard.	Soil blowing hazard.	Low----------	Low.
Severe: rapid permeability.	Severe: poor slope stability.	Rapid intake rate.	Soil blowing hazard.	Soil blowing hazard.	Low----------	Low.
None to slight.	Moderate: fair slope stability.	Slow intake rate.	Features generally favorable.	Difficult to establish desirable vegetation.	High: clay texture.	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as a source of--		Degree of limitations and soil features affecting--			
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Weymouth: WeB, WeC.	Fair: clay loam texture.	Fair: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Moderate: moderate permeability.	Moderate: moderate permeability.
Wichita: WhB, WhC.	Fair: 5 to 10 inches of silt loam.	Fair: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight where slopes are 1 to 2 percent; moderate where slopes are 2 to 5 percent.
Woodward: WoC--- For Quinlan part of WoC, see Quinlan series.	Good----------	Fair: fair traffic supporting capacity; 24 to 48 inches of material.	Severe where bedrock is at depth of 24 to 36 inches; moderate where bedrock is at depth of 36 to 48 inches; fair traffic supporting capacity.	Moderate where bedrock is at depth of 24 to 48 inches; fair traffic supporting capacity.	Moderate where bedrock is at depth of 24 to 48 inches; moderate permeability.	Severe where bedrock is at depth of 24 to 40 inches; moderate where bedrock is at depth of 40 to 48 inches; moderate permeability.
Yahola: Ya-----	Good----------	Fair: fair traffic supporting capacity.	Moderate: fair traffic supporting capacity.	Severe: flood hazard.	Severe: flood hazard.	Severe: moderately rapid permeability.

OF SOIL PROPERTIES--Continued

Degree of limitations and soil features affecting--Continued		Soil features affecting--			Degree of corrosivity and contributing soil features	
Farm ponds		Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
Reservoir area	Embankments					
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Moderately deep soil.	Features generally favorable.	Features generally favorable.	Moderate: clay loam texture.	Low.
Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.	Moderate: clay loam texture.	Low.
Severe where bedrock is at depth of 24 to 36 inches; moderate where bedrock is at depth of 36 to 48 inches; moderate permeability.	Moderate: poor resistance to piping and erosion.	Moderately deep soil.	Soil blowing hazard.	Soil blowing hazard.	Low----------	Low.
Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately rapid intake rate.	Soil blowing hazard.	Soil blowing hazard.	High: conductivity.	Low.

detailed field investigations and for indicating the kinds of problems that may be expected.

Some terms used by soil scientists may be unfamiliar to engineers, and some words have different meanings in soil science than they have in engineering. Among the terms that have special meaning in soil science are gravel, sand, silt, and clay. These and other terms are defined in the glossary at the back of this survey.

Engineering Classification Systems

The three systems most commonly used in classifying samples of soil horizons for engineering are the USDA system devised by the United States Department of Agriculture; the Unified system (7) used by the SCS engineers, Department of Defense, and others; and the AASHO system (1) adopted by the American Association of State Highway Officials.

In the system used by the United States Department of Agriculture, texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the glossary of this report.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter (3). Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CH or MH.

The AASHO system is used to classify soils according to those properties that affect use in highway construction. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index (3). In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation) and, at the other extreme, clay soils that have low strength when wet. The best soils for subgrade are therefore classified as A-1, the next best A-2, and so on to class A-7, the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, and A-7-5, A-7-6. If soil material is near a classification boundary it is given a symbol showing both classes: for example, A-2 or A-4.

Estimated Soil Properties Significant in Engineering

Table 3 provides estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and detailed experience in working with the individual kind of soil in the survey area.

The soils are placed in one of four hydrologic groups on the basis of intake of water at the end of long-duration storms occurring after prior wetting and opportunity for swelling and without the protective effects of vegetation. The groups range from open sands (lowest runoff potential-Group A) to heavy clays (highest runoff potential-Group D). Descriptions of these four groups are as follows:

Group A: Soils having high infiltration rates even when thoroughly wetted, consisting chiefly of deep, well drained to excessively drained sands, gravel, or both. These soils have a high rate of water transmission and a low runoff potential.

Group B: Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well drained to well drained soils that have moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission and a moderate runoff potential.

Group C: Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of (1) soils with a layer that impedes the downward movement of water, or (2) soils with moderately fine to fine texture and a slow infiltration rate. These soils have a slow rate of water transmission and a high runoff potential.

Group D: Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clay soils with a high swelling potential; (2) soils with a high permanent water table; (3) soils with claypan or clay layer at or near the surface; and (4) soils shallow over nearly impervious materials. These soils have a very slow rate of water transmission and a very high runoff potential.

In the column "Depth to Bedrock," the depth is in inches from the surface of the soil to the consolidated material.

The data on percentage passing sieves in table 3 show a range in percentage of soil materials passing four different sieve sizes. This information is useful in helping to determine suitability of the soil as a source of material for construction purposes. Since the estimates are for modal soils, considerable variation in the grain size of any specified soil should be anticipated.

Permeability, as used in table 3, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available water capacity is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value, and relative terms used to describe soil reaction, are explained in the glossary.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures constructed in, on, or with such materials.

Salinity, depth to water table, and drainage were not included on table 3, as these are not problems in Kent County. Some Clairemont, Frio, Mangum, Randall, and Yahola soils are temporarily flooded following large rains. Clairemont, Frio, and Yahola have a few small saline spots. Mangum soils have a water table 4 to 15 feet below the surface.

Engineering Interpretations of Soil Properties

Table 4 contains selected information useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, and sewage disposal systems. The soil features affecting the use of the soil are shown. The ratings and other interpretations in this table are based on estimated engineering properties of the soils in table 3, on available test data, and on field experience. The information applies only to soil depths indicated in table 3. It is reasonably reliable to depths of about 6 feet for most soils, and several more for some.

Topsoil refers to soil material, ordinarily rich in organic matter, suitable for use as topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such use.

Sand and gravel ratings are not included in this table, as the soils of Kent County generally are not considered suitable sources. The Polar soils are a fair source of gravel.

Road subgrade is material used to build embankments. The ratings indicate performance of soil material moved from borrow areas for these purposes.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. A rating is given and the soil features affecting the rating are shown.

The factors considered for foundations for low buildings are those features and qualities of undisturbed soils that affect the suitability for supporting foundations of buildings less than three stories high. The foundations of a building transmit the weight of the structure onto the natural undisturbed soils. It is the substratum of the soil that usually provides the base for foundations and therefore is the material to be evaluated. The Unified Classification System was used for evaluating the soils in terms of their bearing capacity, shrink-swell potential, and shear strength.

Soil features that determine the limitations for septic tank filter fields and sewage lagoons are permeability, ground-water level, hazard of flooding, slope of the soil, depth to rock or other impervious materials, and existence of creviced material that might cause pollution of water supplies.

The suitability of soils for reservoir areas depends primarily upon the seepage rate. The highly plastic soils have low seepage, and coarse textured soils that do not have any binding or sealing characteristics have high seepage.

The factors considered for farm pond embankments are those features and qualities of disturbed soils that affect their suitability for constructing embankments. Both the subsoil and substratum are evaluated where they are contrasting in character and have significant thickness for use as borrow. The primary features that affect suitability are stability, compaction characteristics, susceptibility to piping, shrink-swell potential, compacted permeability, compressibility, erosiveness, and gypsum content.

Suitability of a soil for irrigation depends largely on intake rate, available water capacity, depth of soil, slope, and flooding hazard.

Terraces and diversions constructed from coarse textured soils are difficult to maintain. Soil blowing and water erosion are serious hazards in maintaining terrace ridges and channels at desired specifications. Level terraces, graded terraces, and diversion terraces are constructed in the county.

Factors considered for waterways are erosion, depth to bedrock, and ease in establishing desired plants.

Corrosivity ratings are given for soils of the county for uncoated steel and concrete. Steel pipe should have a protective coating to retard corrosion when placed in any soil in this county.

In this section, the wildlife in the county is briefly discussed, and the soil associations are placed in three broad wildlife sites.

Wildlife can be a profitable natural resource for the farmer and rancher, depending upon how the land is used and managed. Farmers and ranchers in Kent County are discovering that with the increasing population and expanding cities, demand for places to hunt and fish are growing each year. Areas used as wildlife habitats provide economic returns from the sale of hunting and fishing rights. About 87 percent of the county is range, much of it is rough, broken, and rolling to steep. Many of the cultivated fields in the county are idle or planted in crops that also provide a good habitat for wildlife.

Kent County once had an abundance of wildlife, such as buffalo, antelope, prairie dog, and prairie chicken. With the coming of settlers, buffalo hunters, and overgrazing by livestock, these animals and birds were greatly reduced in number and some almost killed out. The kinds of wildlife that now abound in the county are quail, dove, rabbit, deer, turkey, hawks, various songbirds, small animals, and predators.

Many ponds in the county, although used primarily for livestock water, are stocked with fish to provide recreation and fishing enjoyment. Others could be easily stocked with largemouthed bass, channel catfish, and sunfish, the major fish raised in this area.

Wildlife Sites

The soils of Kent County are grouped in three wildlife sites. Each of these wildlife sites consists of one or more of the soil associations discussed in the section "General Soil Map" and shown on a map at the back of this survey. Each site is different in topography, productivity, vegetation, kinds of wildlife, and treatment needed to maintain or improve a desired wildlife habitat. In each wildlife site description, the topography and the wildlife food and cover are detailed and the principal wildlife kinds named.

Assistance on wildlife problems can be obtained from employees of the Soil Conservation Service assisting the Duck Creek Soil and Water Conservation District, from the Texas Agricultural Extension Service, and from the Texas Parks and Wildlife Department.

Wildlife Site 1

The major soil associations in this site are the Miles, Obaro-Paducah, and Olton-Weymouth associations. The soils are loams, fine sandy loams, and clay loams that are nearly level to gently sloping. Most of the cultivated soils in the county are in this site. Most of the deer in the county are on the Obaro and Paducah soils in this site.

The native vegetation consists of short and mid grasses and a thick overstory of mesquite trees. Crops grown on the cultivated areas supply seasonal food for quail, dove, songbirds, and rabbits. Weeds and brush growing along fence rows bordering cropland provide food and cover for rabbits, quail, and songbirds. Sufficient cover for wildlife is not always available on this site, especially in the large blocks of cultivated land. Food is in good supply when crop and weed seeds ripen. Water is available in most areas of this site, except in some of the large cultivated areas.

The principal kinds of wildlife are rabbits, coyote, bobcat, deer, quail, dove, and songbirds.

Wildlife Site 2

The soil association in this site is the Nobscot-Brownfield association. The soils in this association are nearly level to undulating fine sands. Only a small part of the soils of this site is cultivated. Many areas formerly cultivated have been returned to grass or are idle.

The native vegetation is mostly tall and mid grass with an overstory of shin oak and scattered mesquite trees. This site provides particularly good food and cover for deer, antelope, and quail. Old fence rows around formerly cultivated fields provide good food and cover for quail, rabbits, and songbirds. Water normally is in short supply on this site. The soils and topography are not suitable for ponds, and windmill water is not available in all locations. Crops grown in cultivated fields provide food for wildlife for a part of the year.

Principal kinds of wildlife are deer, rabbits, bobcat, coyote, antelope, quail, dove, and songbirds.

Wildlife Site 3

The soil associations in this site are the Quinlan-Rough broken land-Woodward and the Vernon-Wichita associations. This wildlife site contains very fine sandy loams, silt loams, and clay loams. A complex series of gently sloping to steep ridges marked by knolls and a well-defined drainage system are typical of the site's topography. Cultivated fields in this site are limited mainly to the bottomland soils along the rivers and creeks. Crops grown on these scattered cultivated areas supply an important part of the yearly food supply for quail, deer, turkey, and dove.

The native vegetation consists of short, mid, and tall grasses with an overstory of juniper and mesquite. Cover, made up of juniper and mesquite, is adequate for most kinds of wildlife. Food is limited in some parts of this site. Water is adequate in most places.

Principal kinds of wildlife are deer, bobcat, coyote, fox, rabbits, quail, dove, turkey, and songbirds.

FORMATION AND CLASSIFICATION OF THE SOILS

This section explains how soils form and the factors that are involved in their formation. It describes briefly the system of soil classification used in the United States and shows how the soils of Kent County have been classified. Technical terms used in this section are defined in the glossary at the back of this report.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent materials; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are active factors of soil genesis. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. It may be much or little, but some time is always required for horizon differentiation. Usually a long time is required for the development of distinct horizons.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent Material

Parent material is the unconsolidated mass from which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil.

The soils formed from five different kinds of parent material: (1) alluvial outwash; (2) material from clayey and shaley red beds and sandstones of Triassic and Permian age; (3) recent deposits of alluvium; (4) wind-deposited sands; and (5) sandy and silty red beds of Permian age. Many of the soils formed in alluvial outwash. Among these are the Abilene, Brownfield, Miles, Nobscot, Olton, and Springer soils.

Vernon and Wichita are examples of soils formed in material derived from the exposed red-bed clays and shales. Latom and Spade are examples of soils formed in material weathered from sandstones of the Triassic or Permian age.

The parent material of soils on the flood plains of the rivers and drainageways of the county consists of recent deposits of alluvium. Soils formed in these deposits are those of the Clairemont, Frio, Lincoln, Mangum, and Yahola series.

A thick mantle of wind-deposited sand covers some areas along Duck Creek and the two branches of the Brazos River. This sand has been blown from the creek and river channels. Soils of the Tivoli series formed in this sandy material.

The Permian red-bed materials are dominantly soft, very fine grained sandstone, packsand, and silty shale interbedded with layers of soft and hard gypsum. Soils of the Obaro, Paducah, Quinlan, and Woodward series formed in this material.

Climate

Climate influences the formation of soil directly through rainfall, temperature, and wind and indirectly through its influence on the amount and kind of vegetation and animal life. Kent County has a warm-temperate, continental type of climate. It is characterized by dry winters and high summer humidity. Because of high winds, evaporation is high, and seldom does rainwater move below the normal rooting zone. Calcium carbonate has been leached from the upper horizons of about half of the soils in the county. Brownfield, Miles, Nobscot, and Springer are examples of soils that have lost calcium as a result of leaching. Calcium carbonate has accumulated in layers in many of the soils. Another lower layer is made up of clay particles that have moved down in the profile simultaneously with or after the leaching of calcium. The wide variation in temperature has favored the weathering of parent materials to form soil.

Wind has had and is still having an effect on the formation of soils in the county. It aids in the breakdown of parent material, in reworking many deposits, and in shifting materials from place to place.

Living Organisms

Vegetation, micro-organisms, earthworms, and other forms of life that live on and in the soils contribute to soil development. The type and amount of vegetation are important. They are determined partly by the climate and partly by the kind of parent material.

The mixed prairie type of vegetation contributed large amounts of organic matter to the soils. This organic matter was derived from decaying leaves, stems, and roots. The decay of these leaves, stems, and roots was brought about by micro-organisms and bacteria.

Many other forms of life began working and churning the soil after it had been enriched with organic matter. Earthworms are the most noticeable form of animal life in the soil. Worm casts and channels occupy a large percentage of the soil. Worm channels facilitate the movement of air, water, and plant roots in the soil.

Soil-dwelling rodents have had a part in the development of some soils. Large prairie-dog towns once thrived in various parts of the county. The burrowing of these animals brought limy material to the surface and, thus, did much to offset the leaching of free lime from the soil. Some soil structure, however, was destroyed at the same time.

Man's influence on the soil-forming factors cannot be ignored. Man's first step was to fence the range, then overgraze it, and thus alter the vegetation. By tilling the soil, harvesting crops, and allowing runoff and soil blowing, he has reduced the amount of organic matter and of silt and clay particles in the plow layer. By the use of heavy machinery, and by poorly timed tillage, he has compacted the soil and reduced the movement of water, air, and plant roots. Man has also drastically changed the moisture relationships in some areas by irrigation. The changes made by man in the past 60 years have shown marked effects on the soils of the county and will be reflected in the rate of development in the future.

Relief

Relief influences soil development in Kent County through its effect on drainage and runoff. The position on a landscape on which a soil develops influences the characteristics of that soil. Soils that have developed in low, concave areas are dark colored, are deep, and are generally finer textured than soils that have developed in more sloping areas. This is because the soils in low, concave areas receive extra water, lose less water by runoff, and are less subject to erosion. In addition, these soils produce more residues and support more biological activity.

In large part, the soils in Kent County developed in gently sloping to steep areas. These soils are lighter colored than those in level or concave areas. As the slope becomes steeper, the soils become less deeply developed. The steeper soils are shallower, mainly because geologic erosion occurs as fast as the soils are developed. The shallow Quinlan soils are an example. These soils have been developing as long as the Obaro, Paducah, and Woodward soils; but because they occur in less favorable positions, they have not formed deep, clearly expressed horizons.

Time

The characteristics of a soil are strongly affected by the length of time that the soil-forming factors have acted upon the soil. Soil parent materials that have been in place for only a short time have not yet been influenced enough by climate and living organisms to develop well-defined and genetically related soil horizons. Examples of such very young soils in Kent County are the Clairemont, Lincoln, and Yahola soils, which have formed in recent alluvium.

The steeper soils have less developed profiles, because geologic erosion has removed the products of soil formation. The steep areas of Quinlan soils are examples of such less developed soils. Soils that have been in place for a long time have approached equilibrium with their environment in soil development, and they have well-developed profiles. These soils show marked horizon differentiation. They are generally well-drained, nearly level and gently sloping soils, as represented by the Abilene, Miles, and Olton soils

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (2) and revised later (4). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (3) and adopted in 1965 (6). It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 5 shows the classification of each soil series of Kent County by family, subgroup, and order, according to the current system.

TABLE 5.--CLASSIFICATION OF SOIL SERIES IN THE CURRENT SYSTEM

Series	Family	Subgroup	Order
Abilene	Fine, mixed, thermic	Pachic Argiustolls	Mollisols.
Berda	Fine-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Brownfield	Loamy, mixed, thermic	Arenic Aridic Paleustalfs	Alfisols.
Clairemont	Fine-silty, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Cobb	Fine-loamy, mixed, thermic	Udic Haplustalfs	Alfisols.
Cottonwood	Fine-carbonatic, thermic, shallow	Ustic Torriorthents	Entisols.
Enterprise	Coarse-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Frio 1/	Fine-mixed, thermic	Cumulic Haplustolls	Mollisols.
Latom	Loamy, mixed (calcareous), thermic	Lithic Ustic Torriorthents	Entisols.
Lincoln	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Mangum	Fine, mixed (calcareous), thermic	Vertic Ustifluvents	Entisols.
Miles	Fine-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Nobscot	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols.
Obaro	Fine-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Olton	Fine, mixed, thermic	Aridic Paleustolls	Mollisols.
Paducah	Fine-silty, mixed, thermic	Typic Haplustalfs	Alfisols.
Polar	Loamy-skeletal, mixed, thermic	Ustollic Calciorthids	Aridisols.
Quinlan	Loamy, mixed, thermic, shallow	Typic Ustochrepts	Inceptisols.
Randall	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Spade	Coarse-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Springer	Coarse-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Tivoli	Mixed, thermic	Typic Ustipsamments	Entisols.
Vernon	Fine, mixed, thermic	Typic Ustochrepts	Inceptisols.
Weymouth	Fine-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Wichita	Fine, mixed, thermic	Typic Paleustalfs	Alfisols.
Woodward	Coarse-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Yahola	Coarse-loamy, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.

1/ The Frio soils mapped in Kent County are redder below a depth of 14 inches than is defined for the series, but this does not alter their use or behavior.

CLIMATE AND SOIL USE 5/

The climate of Kent County is subtropical. Winters are dry and summers are hot and humid. The range between annual extremes of temperatures is large, a characteristic of a continental type of climate. Only 7 years of temperature and precipitation records are available from Jayton, Tex. This is much too short a period for the computation of a reliable average, but on the basis of long-term records from surrounding counties, the total annual rainfall in Kent County is estimated at 20 to 21 inches. Rainfall occurs most frequently as the result of thunderstorms. Monthly and annual amounts are extremely variable. In Garza County, near Polar in the southwestern corner of Kent County, the wettest and driest years of record were consecutive. A total of 30.33 inches fell in 1955, but only 5.91 inches fell in 1956.

May is usually the wettest month. Moist tropical air from the Gulf of Mexico is carried far inland across Texas late in spring. This air mass produces moderate to heavy afternoon and evening thundershowers. A secondary rainfall peak occurs in September. At that time, cold fronts, which are ordinarily absent in summer, again invade the area and clash with the warm, moisture-laden tropical air.

Approximately three-fourths of the average annual precipitation falls during the warm season, April through October. Periods of drought, or rainfall deficiency, are rather common. During exceptionally wet years, much of the total rainfall results from heavy downpours that produce excessive runoff and erosion of the soil. Occasionally, thunderstorms are accompanied by heavy rain, high winds, and hail. This can be a disastrous combination for crops. The most violent thunderstorms usually occur late in spring or early in summer. In an average year, thunderstorms occur on 42 days.

In the period November through March, moisture-laden air from the Gulf of Mexico is rather effectively cut off by frequent surges of drier polar air. For this reason winter precipitation is relatively light. Usually it falls as a slow general rain or drizzle, rather than in the showers typical late in spring, in summer, and early in fall.

5/ By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

TABLE 6.--TEMPERATURE

[Temperature data from Spur, Dickens County; precipitation data from weather station in

Month	Temperature	Precipitation						
	Normal monthly 1/	Monthly average 2/	Probability, in percent, of receiving selected amounts during month					
			0 or a trace	0.50 inch or more	1 inch or more	2 inches or more	3 inches or more	4 inches or more
	° F.	Inches						
January----	42.2	0.62	10	50	30	8	3	<1
February---	46.1	.65	11	53	30	10	3	1
March------	52.8	.60	8	58	30	9	3	1
April------	62.6	1.13	<1	77	60	30	15	5
May--------	70.6	3.10	<1	97	92	72	52	37
June-------	79.5	2.51	1	85	70	50	30	20
July-------	81.9	2.32	1	80	65	43	20	10
August-----	81.2	1.74	4	73	55	34	17	9
September--	74.0	2.93	8	75	60	37	26	17
October----	63.9	1.77	3	82	82	43	26	17
November---	51.1	.68	16	50	30	10	5	2
December---	44.2	.61	8	53	33	14	5	2
Year-----	62.5	18.66						

1/ Average length of record, 30 years.

2/ Average length of record, 21 years.

3/ Average length of record, 15 years.

Garza County near Polar, elevation 2,330 feet. The symbol < means less than]

Precipitation--Continued							
Probability, in percent, of receiving selected amounts during month--Continued		Number of days that have--[3]			Snow, sleet		
5 inches or more	6 inches or more	0.10 inch or more	0.50 inch or more	1 inch or more	Monthly average [4]	Monthly maximum [4]	Greatest depth [5]
					Inches	Inches	Inches
<1	<1	2	(6)	(6)	1.0	5.5	6
<1	<1	2	(6)	(6)	1.1	6.7	7
<1	<1	2	(6)	(6)	.2	2.0	2
4	1	3	1	(6)	0	0	0
23	10	5	2	1	0	0	0
11	10	5	2	1	0	0	0
10	5	4	1	1	0	0	0
6	3	3	1	(6)	0	0	0
10	8	3	2	1	0	0	0
9	5	3	1	1	0	0	0
<1	<1	2	1	0	.6	4.5	3
1	<1	2	(6)	(6)	1.2	13.8	5
		36	11	5	4.1	13.8	6

[4] Average length of record, 16 years.

[5] Average length of record, 11 years.

[6] Less than one half.

Snow falls occasionally during winter but is not a significant source of moisture. The average monthly snowfall is unduly influenced by rare, but exceptionally heavy, snows that may occur once within a 10- to 20-year period.

Temperatures, like rainfall, are extremely variable, especially during the colder months, November through March. Cold fronts are frequent during this period, and often are accompanied by rapid drops in temperature. Sunshine and southwesterly winds bring rapid warming, so cold spells rarely last more than about 48 hours. Normal monthly temperatures for Spur, in adjacent Dickens County, are given in table 6.

Southwesterly winds prevail in November and through March, and southerly winds in April through October. Wind speeds are strongest during intense thunderstorms, but these are "squalls" of short duration. The strongest continuous winds blow in February, March, and April. Occasionally, these winds produce dust storms early in spring.

Kent County receives about 73 percent of the total possible sunshine annually. Cloudiness is most prevalent in winter, so that seasonally, total sunshine received varies from about 65 percent in winter to 80 percent in summer. Seasonal changes in relative humidity are small, but daily variations are significant. The average annual relative humidity is estimated at 76 percent at 6:00 a.m., 47 percent at noon, and 43 percent at 6:00 p.m. The average annual Class "A" (4-foot, Weather Bureau-type) pan evaporation is estimated at 100 inches. Approximately two-thirds of this amount evaporates during the 6-month period, May through October. The average annual lake evaporation is estimated at 70 inches.

The average length of the warm season (freeze-free period) in Kent County is 216 days. The average dates of the last occurrence of 32°F (or lower) in the spring, and the first occurrence of 32°F (or lower) in the fall, are April 4 and November 6, respectively. One year in five, on an average, a freeze occurs after April 15; also, 1 year in 5, on an average, a freeze occurs before October 30. Significant departures from the above dates are likely to occur at various locations within Kent County because topography, drainage, wind, slope, soil characteristics, and vegetative cover all affect temperature. The average length of the period between the last occurrence of 28°F (or lower) in the spring and the first occurrence of 28°F (or lower) in the fall is 238 days.

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GLOSSARY

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are--

Loose.--Noncoherent when dry or moist; does not hold together in a mass.

Friable.--When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.--When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.--When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.--When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.--When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.--When dry, breaks into powder or individual grains under very slight pressure.

Cemented.--Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although

mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.--The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.--The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.--The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.--The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.--Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Munsell notation. A system for designating color by degrees of the three simple variables--hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Outwash material. Soil material that was washed by melt water from areas in the High Plains and Rocky Mountains, then carried by streams and deposited on the Permian and Triassic red beds during the Pleistocene epoch.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour" soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: Very coarse sand (2.0 to 1.0 millimeter); coarse sand (1.0 to 0.5 millimeter); medium sand (0.5 to 0.25 millimeter); fine sand (0.25 to 0.10 millimeter); very fine sand (0.10 to 0.05 millimeter); silt (0.05 to 0.002 millimeter); and clay (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grain (each grain by itself, as in dune sand) or massive (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Terrace An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

GUIDE TO MAPPING UNITS

[For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit or a range site, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 8
Estimated yields, table 2, page 34 .

Engineering uses of the soils, tables 3 and 4, pages 40 through 55.

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page	Range site Name	Range site Page
AbA	Abilene clay loam, 0 to 1 percent slopes	7	IIce-4	30	Deep Hardland	36
BdA	Berda fine sandy loam, 0 to 1 percent slopes	9	IIIe-4	31	Sandy Loam	37
BdB	Berda fine sandy loam, 1 to 3 percent slopes	9	IIIe-5	31	Sandy Loam	37
BdC	Berda fine sandy loam, 3 to 5 percent slopes	9	IVe-9	32	Sandy Loam	37
Bk	Breaks and Yahola soils	9	------	--	----------	--
	Breaks part	----	VIIs-1	33	Rough Breaks	37
	Yahola part	----	VIIs-1	33	Loamy Bottomland	35
BtB	Brownfield and Tivoli soils, undulating	10	VIe-7	33	Deep Sand	37
Ca	Clairemont silt loam	11	IIce-1	30	Loamy Bottomland	35
Cf	Clairemont and Yahola soils, frequently flooded	11	Vw-1	32	Loamy Bottomland	35
CmB	Cobb and Miles fine sandy loams, 1 to 3 percent slopes	12	IIIe-4	31	Sandy Loam	37
CmC	Cobb and Miles fine sandy loams, 3 to 5 percent slopes	12	IVe-4	32	Sandy Loam	37
Co	Cottonwood soils	13	VIIs-1	33	Gypland	39
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes	13	IIe-1	30	Mixedland	37
Fr	Frio clay loam	14	IIce-1	30	Loamy Bottomland	35
LaC	Latom soils, rolling	14	VIIs-1	33	Very Shallow	38
Ln	Lincoln soils	15	Vw-2	32	Sandy Bottomland	36
Ma	Mangum clay	15	IIIs-2	31	Clay Flats	38
MlB	Miles loamy fine sand, 0 to 3 percent slopes	17	IVe-6	32	Sandyland	38
MlD	Miles loamy fine sand, 3 to 8 percent slopes	17	VIe-6	33	Sandyland	38
MnA	Miles fine sandy loam, 0 to 1 percent slopes	16	IIIe-4	31	Sandy Loam	37
MnB	Miles fine sandy loam, 1 to 3 percent slopes	16	IIIe-4	31	Sandy Loam	37
MnC	Miles fine sandy loam, 3 to 5 percent slopes	16	IVe-4	32	Sandy Loam	37
MsC2	Miles soils, 2 to 6 percent slopes, eroded	17	VIe-6	33	Sandy Loam	37
Nb	Nobscot and Brownfield soils	18	VIe-7	33	Deep Sand	37
NtB	Nobscot and Tivoli soils, undulating	18	VIe-7	33	Deep Sand	37
ObB	Obaro loam, 1 to 3 percent slopes	19	IIe-1	30	Mixedland	37
ObC	Obaro loam, 3 to 5 percent slopes	19	IIIe-3	31	Mixedland	37
OcA	Olton clay loam, 0 to 1 percent slopes	20	IIce-4	30	Deep Hardland	36
OcB	Olton clay loam, 1 to 3 percent slopes	20	IIIe-2	30	Deep Hardland	36
PaB	Paducah loam, 1 to 3 percent slopes	21	IIe-1	30	Mixedland	37
PgB	Polar gravelly loam, undulating	21	VIIs-1	33	Gravelly	39
PhD	Polar and Berda soils, hilly	22	------	--	----------	--
	Polar part	----	VIIs-1	33	Gravelly	39
	Berda part	----	VIIs-1	33	Sandy Loam	37
QuC	Quinlan soils, sloping	22	VIe-4	32	Mixedland	37
Ra	Randall clay	23	VIw-1	33	(1/)	--
Ro	Rough broken land	23	VIIs-2	33	Rough Breaks	37
SdB	Spade fine sandy loam, 1 to 3 percent slopes	24	IIIe-8	31	Sandy Loam	37
SdC	Spade fine sandy loam, 3 to 5 percent slopes	24	IVe-5	32	Sandy Loam	37
SgB	Springer loamy fine sand, 0 to 3 percent slopes	25	IVe-11	32	Sandyland	38
SgD	Springer loamy fine sand, 3 to 8 percent slopes	25	VIe-6	33	Sandyland	38
Tv	Tivoli fine sand	25	VIIe-1	33	Deep Sand	37
VeC	Vernon soils, sloping	26	VIe-1	32	Shallow Redland	38
VrC	Vernon-Badland complex, sloping	26	VIIs-1	33	Shallow Redland	38
WeB	Weymouth clay loam, 1 to 3 percent slopes	27	IIIe-7	31	Shallow Redland	38
WeC	Weymouth clay loam, 3 to 5 percent slopes	27	IVe-2	31	Shallow Redland	38
WhB	Wichita silt loam, 1 to 3 percent slopes	27	IIIe-2	30	Deep Hardland	36
WhC	Wichita silt loam, 3 to 5 percent slopes	27	IVe-2	31	Deep Hardland	36
WoC	Woodward and Quinlan loams, sloping	28	VIe-4	32	Mixedland	37
Ya	Yahola very fine sandy loam	29	IIce-3	30	Loamy Bottomland	35

1/ Included in adjoining range site.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

KENT COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

N

CROSBY COUNTY | DICKENS COUNTY | KING COUNTY | STONEWALL COUNTY | GARZA COUNTY | SCURRY COUNTY | FISHER COUNTY

101°00′ | 100°50′ | 100°40′ | 33°20′ | 33°10′ | 33°00′

Girard | JAYTON | Clairemont | Harmony Community | Polar | Cogdell

WHITE RIVER | BRAZOS RIVER | SALT FORK BRAZOS | NORTH FORK DOUBLE MOUNTAIN FORK BRAZOS | Little Duck Creek | Cedar Canyon | Croton Creek | Hot Springs Canyon | Spring Creek | Red Mud Creek | West Prong Duck Creek | Dry Duck Creek | Rattlesnake Creek | Butte Creek | Sand Ct | Maverick Creek | ABC Creek | Sinking Creek | McKenzie | Cooper Creek | Hollow

1081 | 643 | 948 | 70 | 1228 | 2320 | 380 | 1082 | 1231 | 1142

SOIL ASSOCIATIONS

1 Quinlan-Rough broken land-Woodward association: Gently sloping to steep, shallow and moderately deep soils that are very fine sandy loam throughout, and rough broken land

2 Miles association: Nearly level to gently sloping, deep soils that have a fine sandy loam surface layer and sandy clay loam lower layers

3 Nobscot-Brownfield association: Gently undulating, deep soils that have a fine sand surface layer and fine sandy loam or sandy clay loam lower layers

4 Olton-Weymouth association: Nearly level to gently sloping, deep and moderately deep soils that are mainly clay loam throughout

5 Obaro-Paducah association: Gently sloping, moderately deep and deep soils that have a loam surface layer and loam or sandy clay loam lower layers

6 Vernon-Wichita association: Gently sloping to sloping, deep and moderately deep soils that have a clay loam or silt loam surface layer and clay or silty clay loam lower layers

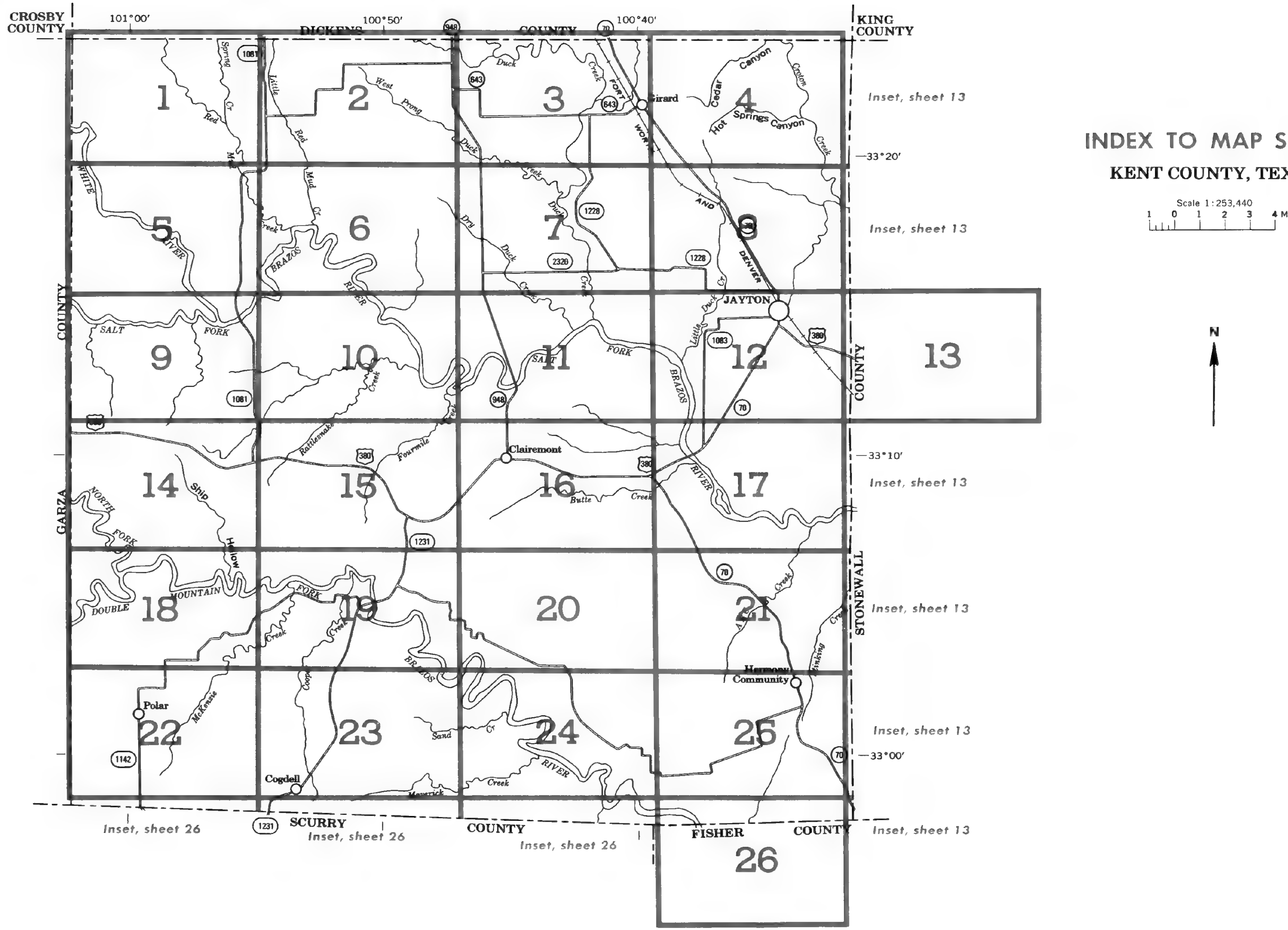
Compiled 1972

This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.

INDEX TO MAP SHEETS

KENT COUNTY, TEXAS

Scale 1:253,440



CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county
- Farm or ranch

Railroads
- Single track
- Multiple track

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Fence

Tanks

Well, oil or gas

Cotton gin

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Well, irrigation (I W.)

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, or D, indicates the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. The final number, 2, in the symbol means that the soil is eroded. (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in places, but the degree of erosion cannot be estimated reliably.

SYMBOL	NAME
AbA	Abilene clay loam, 0 to 1 percent slopes
BdA	Berda fine sandy loam, 0 to 1 percent slopes (W)
BdB	Berda fine sandy loam, 1 to 3 percent slopes (W)
BdC	Berda fine sandy loam, 3 to 5 percent slopes (W)
Bk	Breaks and Yahola soils
BtB	Brownfield and Tivoli soils, undulating (W)
Ca	Clairemont silt loam
Cf	Clairemont and Yahola soils, frequently flooded
CmB	Cobb and Miles fine sandy loams, 1 to 3 percent slopes (W)
CmC	Cobb and Miles fine sandy loams, 3 to 5 percent slopes (W)
Co	Cottonwood soils
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes
Fr	Frio clay loam
LaC	Latom soils, rolling
Ln	Lincoln soils (W)
Ma	Mangum clay
MkB	Miles loamy fine sand, 0 to 3 percent slopes (W)
MkD	Miles loamy fine sand, 3 to 8 percent slopes (W)
MnA	Miles fine sandy loam, 0 to 1 percent slopes (W)
MnB	Miles fine sandy loam, 1 to 3 percent slopes (W)
MnC	Miles fine sandy loam, 3 to 5 percent slopes (W)
MsC2	Miles soils, 2 to 6 percent slopes, eroded
Nb	Nobscot and Brownfield soils (W) *
NtB	Nobscot and Tivoli soils, undulating (W)
ObB	Obaro loam, 1 to 3 percent slopes
ObC	Obaro loam, 3 to 5 percent slopes
OcA	Olton clay loam, 0 to 1 percent slopes
OcB	Olton clay loam, 1 to 3 percent slopes
PaB	Paducah loam, 1 to 3 percent slopes
PgB	Polar gravelly loam, undulating
PhD	Polar and Berda soils, hilly
QuC	Quinlan soils, sloping *
Ra	Randall clay
Ro	Rough broken land *
SdB	Spade fine sandy loam, 1 to 3 percent slopes
SdC	Spade fine sandy loam, 3 to 5 percent slopes
SgB	Springer loamy fine sand, 0 to 3 percent slopes (W)
SgD	Springer loamy fine sand, 3 to 8 percent slopes
Tv	Tivoli fine sand (W)
VeC	Vernon soils, sloping
VrC	Vernon-Badland complex, sloping
WeB	Weymouth clay loam, 1 to 3 percent slopes
WeC	Weymouth clay loam, 3 to 5 percent slopes
WhB	Wichita silt loam, 1 to 3 percent slopes
WhC	Wichita silt loam, 3 to 5 percent slopes
WoC	Woodward and Quinlan loams, sloping *
Ya	Yahola very fine sandy loam

* The composition of these units is more variable than that of the rest of the mapping units in the county, and the delineations are much larger. Mapping has been controlled well enough, however, to allow interpretations for the expected uses.

KENT COUNTY, TEXAS — SHEET NUMBER 1

920 000 FEET

640 000 FEET

630 000 FEET

950 000 FEET

CROSBY CO

DICKENS COUNTY

GARZA COUNTY

PREVIOUSLY PUBLISHED DICKENS COUNTY, TEXAS COUNTY BOUNDARY

WHITE RIVER

Creek

Spring

J.W. CREEK

(Joins sheet 2)

(Joins sheet 5)

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31680

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Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

KENT COUNTY, TEXAS NO. 1

KENT COUNTY, TEXAS — SHEET NUMBER 2

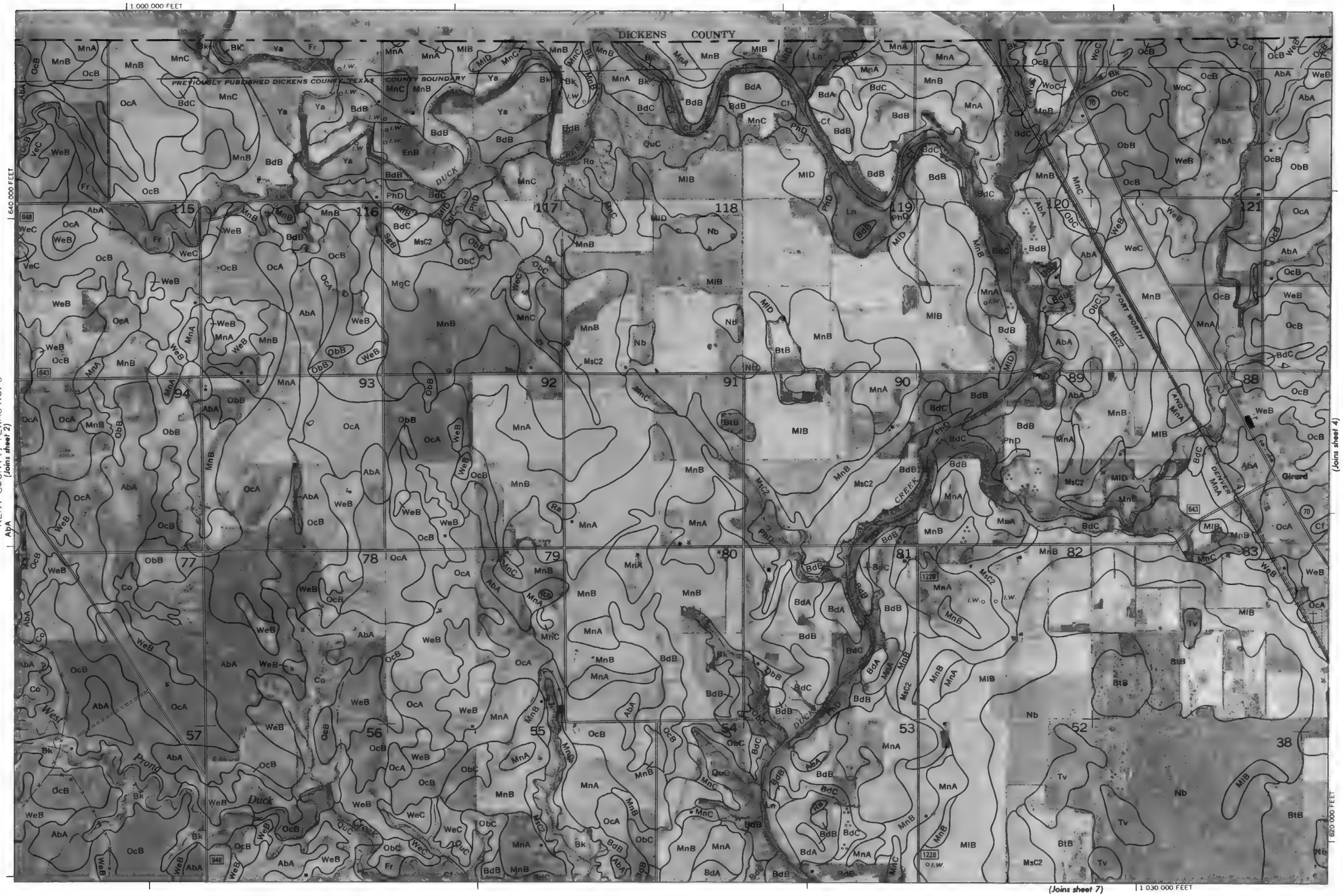
KENT COUNTY, TEXAS NO. 2

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

Land division corners are approximately positioned on this map

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station

KENT COUNTY, TEXAS — SHEET NUMBER 3



KENT COUNTY, TEXAS NO. 3
(Joins sheet 2)

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station
Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map

3

N

3 Miles
2
1
15 000 Feet
10 000
5 000
0
Scale 1:31680
5 000 4 000 3 000 2 000 1 000 0
¾ ½ ¼ 0

(4)

N

1 070 000 FEET

640 000 FEET

DICKENS COUNTY

PREVIOUSLY PUBLISHED DICKENS COUNTY, TEXAS COUNTY BOUNDARY

South Pole Canyon

Cedar Canyon

Hot Springs Canyon

SALT FLAT CREEK

CROTON

Little Duck Creek

FORT WORTH AND DENVER

122 123 87 86 84 85 21 16 15 17 14

3 Miles 2 1 0 1

15 000 Feet 10 000 5 000 0

Scale 1:31680

1/2 1/4 0 1/2 1

1 000 2 000 3 000 4 000 5 000 FEET

(Joins sheet 3)

620 000 FEET

1 040 000 FEET

(Joins sheet 8)

(Joins inset B, sheet 13)

KENT COUNTY, TEXAS NO. 4

Land division corners are approximately positioned on this map

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station

KENT COUNTY, TEXAS — SHEET NUMBER 5

920 000 FEET

620 000 FEET

(Joins sheet 1)

(Joins sheet 6)

610 000 FEET

950 000 FEET

(Joins sheet 9)

RIVER

WHITE

Red Arroyo Tank

Kay Tank

Arroyo

Red

COUNTY

GARZA

RED

MUD

CREEK

water

1081

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31680

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Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

KENT COUNTY, TEXAS NO. 5

KENT COUNTY, TEXAS — SHEET NUMBER 6

(6)

N

3 Miles 2 1 0

15 000 Feet 10 000 5 000 0

5 000 4 000 3 000 2 000 1 000 0

Scale 1:31680

(Joins sheet 5)

(Joins sheet 2)

980 000 FEET

620 000 FEET

600 000 FEET

960 000 FEET

(Joins sheet 10)

(Joins sheet 7)

SALT FORK BRAZOS RIVER

Little Red Mud Creek

KENT COUNTY, TEXAS NO. 6

Land division corners are approximately positioned on this map

Photobase from 1970 aerial photography. Positions of 10 000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station

KENT COUNTY, TEXAS — SHEET NUMBER 7

7

N

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map. Positions of 10,000 foot grid ticks are approximate and based on the Texas coordinate system, north central zone
Photobase from 1970 aerial photography

KENT COUNTY, TEXAS NO. 7

(Joins sheet 6)

(Joins sheet 3)

(Joins sheet 8)

(Joins sheet 11)

1 000 000 FEET

620 000 FEET

600 000 FEET

1 030 000 FEET

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31680

KENT COUNTY, TEXAS — SHEET NUMBER 8

(8)

N

Scale 1:31 680

3 Miles 2 1 0 1 2 3 4 5 Kilometers

15 000 Feet 10 000 5 000 0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 7)

(Joins sheet 4)

1 070 000 FEET

1 610 000 FEET

600 000 FEET

1 040 000 FEET (Joins sheet 12)

(Joins inset A, sheet 13)

KENT COUNTY, TEXAS NO. 8

Land division corners are approximately positioned on this map

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station

KENT COUNTY, TEXAS — SHEET NUMBER 9

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone
Land division corners are approximately positioned on this map

KENT COUNTY, TEXAS NO. 9

920 000 FEET

590 000 FEET

(Joins sheet 5)

(Joins sheet 10)

(Joins sheet 14)

950 000 FEET

570 000 FEET

GARZA COUNTY

SALT FORK BRAZOS RIVER

BRAZOS RIVER

WHITE RIVER

9

N

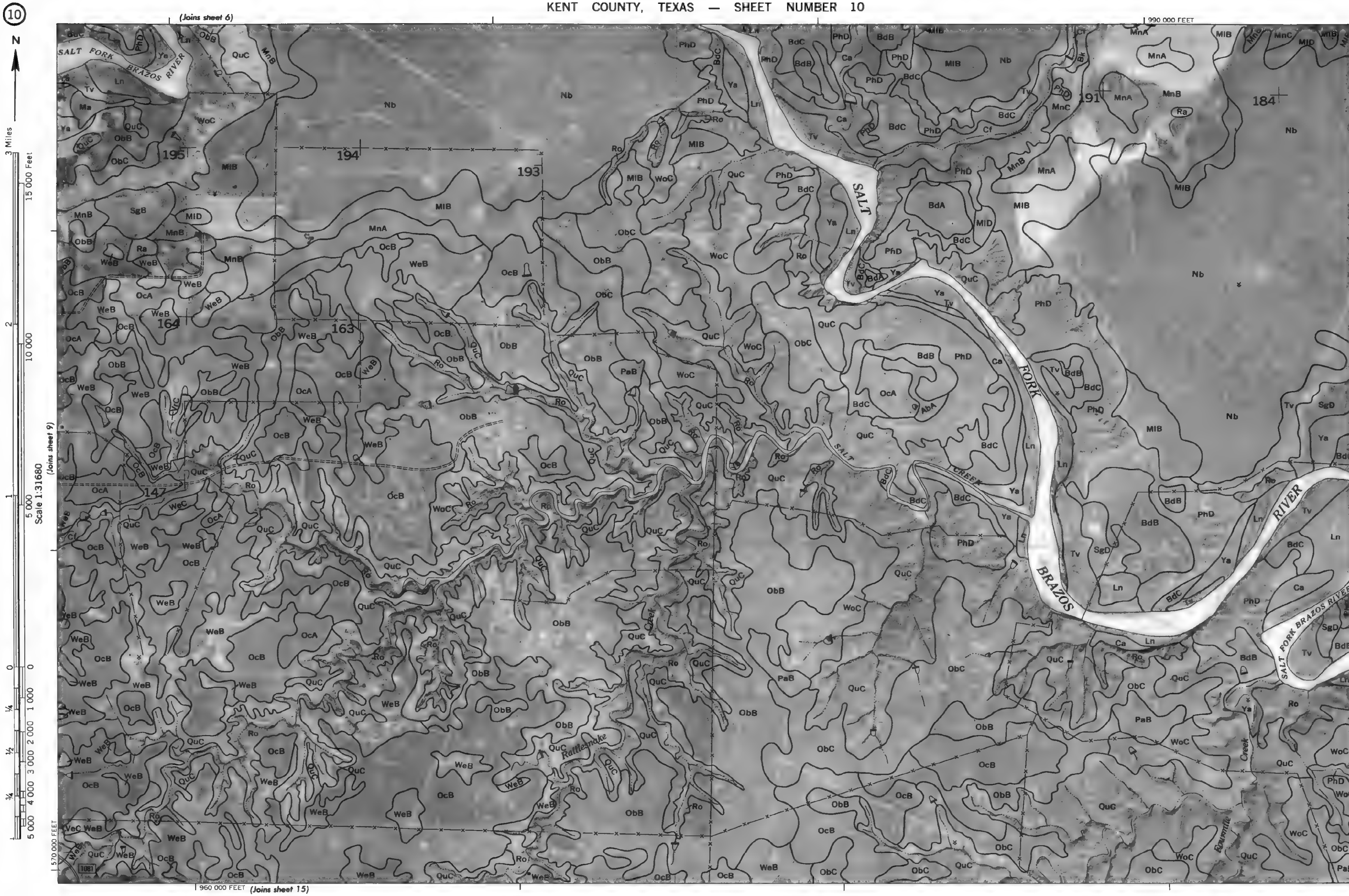
3 Miles 2 1 0 15 000 Feet 10 000 5 000

5 000 4 000 3 000 2 000 1 000 0

1 ¾ ½ ¼ 0

Scale 1:31680

KENT COUNTY, TEXAS — SHEET NUMBER 10



KENT COUNTY, TEXAS NO. 10

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

KENT COUNTY, TEXAS — SHEET NUMBER 11

11

N

(Joins sheet 7)

1 000 000 FEET

590 000 FEET

KENT COUNTY, TEXAS NO. 11

(Joins sheet 10)

(Joins sheet 12)

570 000 FEET

1 030 000 FEET

(Joins sheet 16)

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

(12)

KENT COUNTY, TEXAS — SHEET NUMBER 12

N

Scale 1:31680

3 Miles
15 000 Feet
10 000
5 000
0

KENT COUNTY, TEXAS NO. 12

Land division corners are approximately positioned on this map

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

KENT COUNTY, TEXAS — SHEET NUMBER 13

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station
Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

KENT COUNTY, TEXAS NO. 13

(Joins sheet 12)

(Joins inset A, bottom)

(Joins inset B, bottom)

(Joins inset C, bottom)

(Joins inset D, bottom)

(Joins inset E, bottom)

(Joins inset C, top)

(Joins upper left)
INSET A

(Joins inset A, top)
INSET B

(Joins inset D, top)
INSET C

(Joins inset E, top)
INSET D

(Joins inset F, top)
INSET E

INSET F
2,000 FOOT GRID TICKS

2,000 AND 10,000 FOOT GRID TICKS

1,000 AND 10,000 FOOT GRID TICKS

13

N

3 Miles
2
15 000 Feet
10 000
1
5 000
Scale 1:31680

(Joins sheet 9)

950 000 FEET

570 000 FEET

N

3 Miles 2 1

15 000 Feet 10 000 5 000

Scale 1:31680

5 000 4 000 3 000 2 000 1 000 0 5 000 FEET

¾ ½ ¼ 0

(Joins sheet 18)

920 000 FEET

(Joins sheet 15)

KENT COUNTY, TEXAS NO. 14

Land division corners are approximately positioned on this map

Photobase from 1970 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

KENT COUNTY, TEXAS — SHEET NUMBER 15

15

N

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station
Photobase from 1970 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the Texas coordinate system: north central zone
Land division corners are approximately positioned on this map

KENT COUNTY, TEXAS NO. 15

(Joins sheet 14)

(Joins sheet 10)

(Joins sheet 16)

(Joins sheet 19)

960 000 FEET

990 000 FEET

570 000 FEET

550 000 FEET

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31680

(Joins sheet 11)

1 030 000 FEET

N

3 Miles 15 000 Feet 10 000

Scale 1:31680

1 5 000 0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 15)

550 000 FEET

560 000 FEET

(Joins sheet 20)

1 000 000 FEET

(Joins sheet 17)

KENT COUNTY, TEXAS NO. 16

Land division corners are approximately positioned on this map

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

KENT COUNTY, TEXAS — SHEET NUMBER 17

(17)

N

Scale 1:31680

3 Miles
15 000 Feet
10 000
5 000
0
1 000 2 000 3 000 4 000 5 000

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map

KENT COUNTY, TEXAS NO. 17
(Joins sheet 16)

(18)

(Joins sheet 14)

950 000 FEET

540 000 FEET

N

3 Miles 2 1

15 000 Feet 10 000 5 000

Scale 1:31680

5 000 4 000 3 000 2 000 1 000 0 0

1 ¾ ½ ¼ 0

520 000 FEET

920 000 FEET

(Joins sheet 22)

(Joins sheet 19)

KENT COUNTY, TEXAS NO. 18

Land division corners are approximately positioned on this map

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station

KENT COUNTY, TEXAS — SHEET NUMBER 19

19

N

960 000 FEET

540 000 FEET

(Joins sheet 15)

MID

(Joins sheet 20)

(Joins sheet 23)

990 000 FEET

520 000 FEET

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station
Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

KENT COUNTY, TEXAS NO. 19

(Joins sheet 18)

(20)

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31680

(Joins sheet 16)

1 030 000 FEET

540 000 FEET

(Joins sheet 19)

520 000 FEET

(Joins sheet 24)

1 000 000 FEET

(Joins sheet 21)

KENT COUNTY, TEXAS NO. 20

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

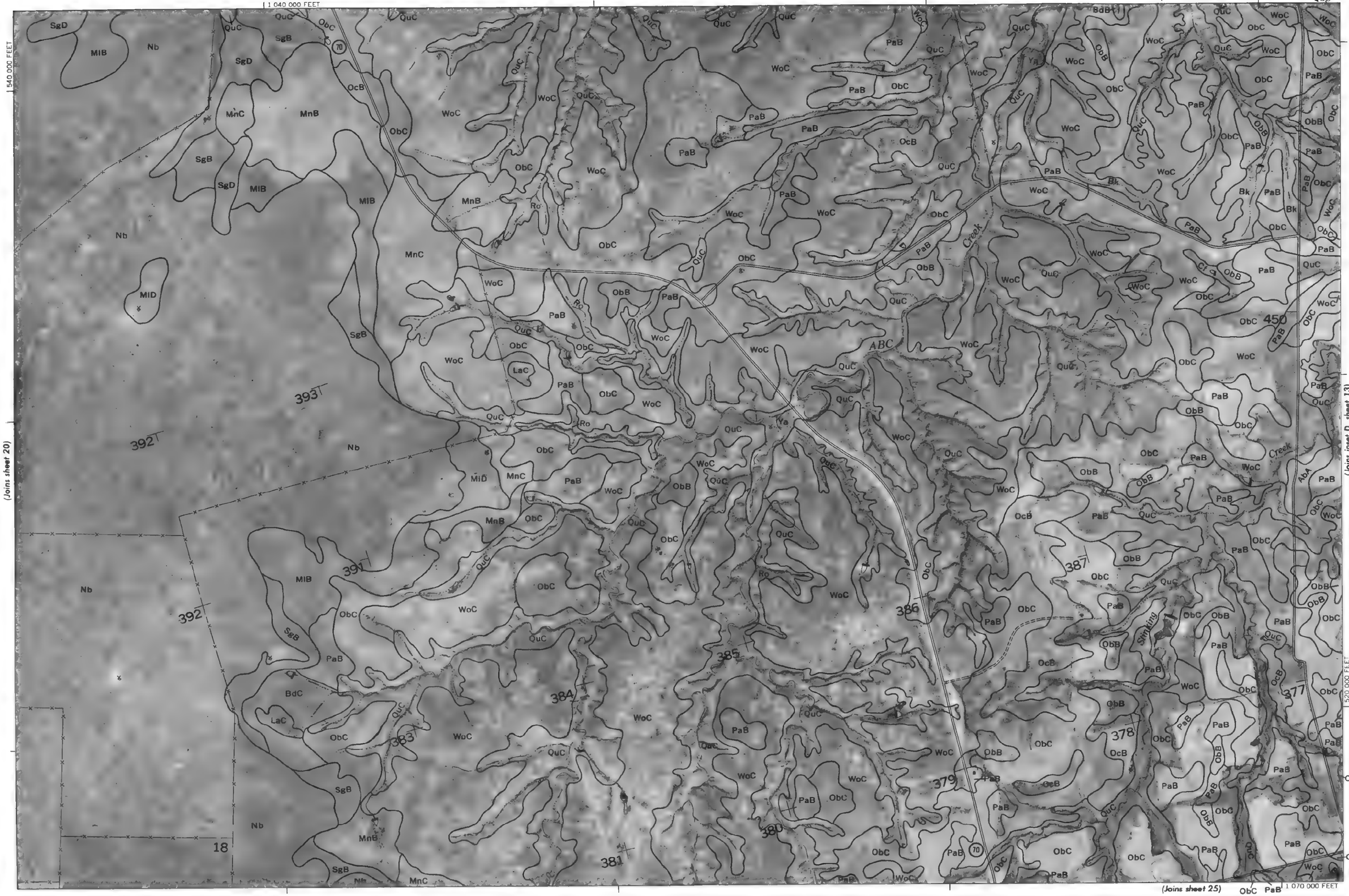
MIB MnA MnB MoA SgB SgD Nb MID BdC BdB PhD Ro WoC QuC Ln Ya Ca

47 48 6 20 17 910 18

SALT FORK BRAZOS RIVER

MOUNTAIN FORK

KENT COUNTY, TEXAS — SHEET NUMBER 21



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

KENT COUNTY, TEXAS NO. 21

21

KENT COUNTY, TEXAS — SHEET NUMBER 22

(22)

N

3 Miles 2 1

15 000 Feet 10 000 5 000

Scale 1:31680

5 000 4 000 3 000 2 000 1 000 0 0

¾ ½ ¼

500 000 FEET

920 000 FEET

950 000 FEET

510 000 FEET

(Joins sheet 18)

(Joins inset C, sheet 26)

GARZA COUNTY

QuC

(Joins sheet 23)

KENT COUNTY, TEXAS NO. 22

Land division corners are approximately positioned on this map

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approx mate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, and the Texas Agricultural Experiment Station

KENT COUNTY, TEXAS — SHEET NUMBER 23

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station
Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

KENT COUNTY, TEXAS NO. 23
(Joins sheet 22)

KENT COUNTY, TEXAS — SHEET NUMBER 24

(24)

N

(Joins sheet 20)

(Joins sheet 23)

(Joins sheet 25)

(Joins inset A, sheet 26)

1 030 000 FEET

510 000 FEET

500 000 FEET

1 000 000 FEET

DOUBLE MOUNTAIN FORK BRAZOS RIVER

Scale 1:31680

3 Miles 15 000 Feet 2 10 000 1 5 000

¾ 0 0 ¼ 1 000

½ 2 000 3 000

¾ 4 000 5 000 1

KENT COUNTY, TEXAS NO. 24

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximately positioned on this map.

Land division corners are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

KENT COUNTY, TEXAS — SHEET NUMBER 25

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

KENT COUNTY, TEXAS NO. 25
(Joins sheet 24)

1 040 000 FEET

510 000 FEET

(Joins sheet 21)

Harmony Community

Collins Creek

Adair Canyon

Ivy

(Joins inset E, sheet 13)

(Joins sheet 26)

1 070 000 FEET

490 000 FEET

25

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31680

26

KENT COUNTY, TEXAS — SHEET NUMBER 26

N

3 Miles

15 000 Feet

2

10 000

1

5 000 Scale 1:31680

0

1 000

¼

2 000

½

3 000

¾

4 000

1

5 000

(Joins sheet 25)

1 070 000 FEET

(Joins inset A, right)

486 000 FEET

(Joins inset F, sheet 13)

488 000 FEET

BdB BdA PhD BdC WoC SgB SgD Nb SgC QuC WeC OcB ObB ObC Ro PaB Ya Ln Ca Fr MnC WoC PaB

DOUBLE MOUNTAIN FORK BRAZOS RIVER

SCURRY COUNTY

FISHER COUNTY

1 040 000 FEET

INSET A

(Joins sheet 24)

1 030 000 FEET

(Joins inset B, right)

486 000 FEET

(Joins inset A, left)

490 000 FEET

Ro QuC OcB PgB PhD Ya Lr WhB Ln BdB BdC BdA WoC

DOUBLE MOUNTAIN FORK BRAZOS RIVER

SCURRY COUNTY

1 000 000 FEET

INSET B

(Joins sheet 23)

990 000 FEET

(Joins inset C, right)

490 000 FEET

(Joins inset A, left)

490 000 FEET

OcB VeC BdC PgB SdC CmB WoC Ro QuC WhB WhC WeB OcA

SCURRY COUNTY

960 000 FEET

INSET C

(Joins sheet 22)

950 000 FEET

(Joins inset B, left)

492 000 FEET

GARZA COUNTY

VeC WeB CmB CmC SdC OcB VrC Ro BdB BdC PgB Cf SdB LaC Fr CmB

SCURRY COUNTY

920 000 FEET

2,000 AND 10,000 FOOT GRID TICKS

KENT COUNTY, TEXAS NO. 26 (Joins upper left)

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.